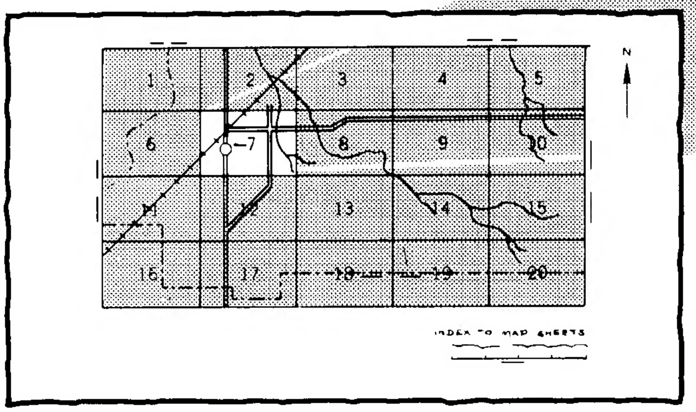
SOIL SURVEY OF

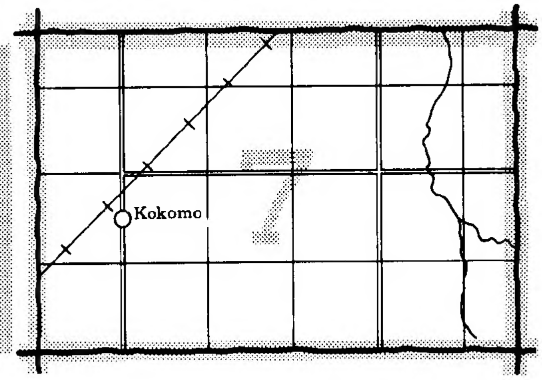
McLean and Muhlenberg Counties, Kentucky

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Kentucky Department for Natural Resources and
Environmental Protection and
Kentucky Agricultural Experiment Station

HOW TO USE

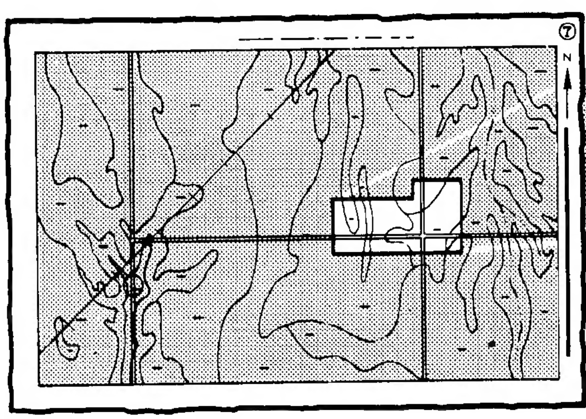
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

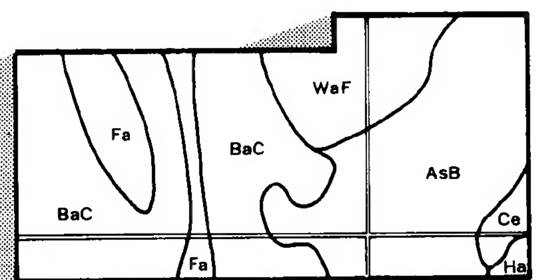




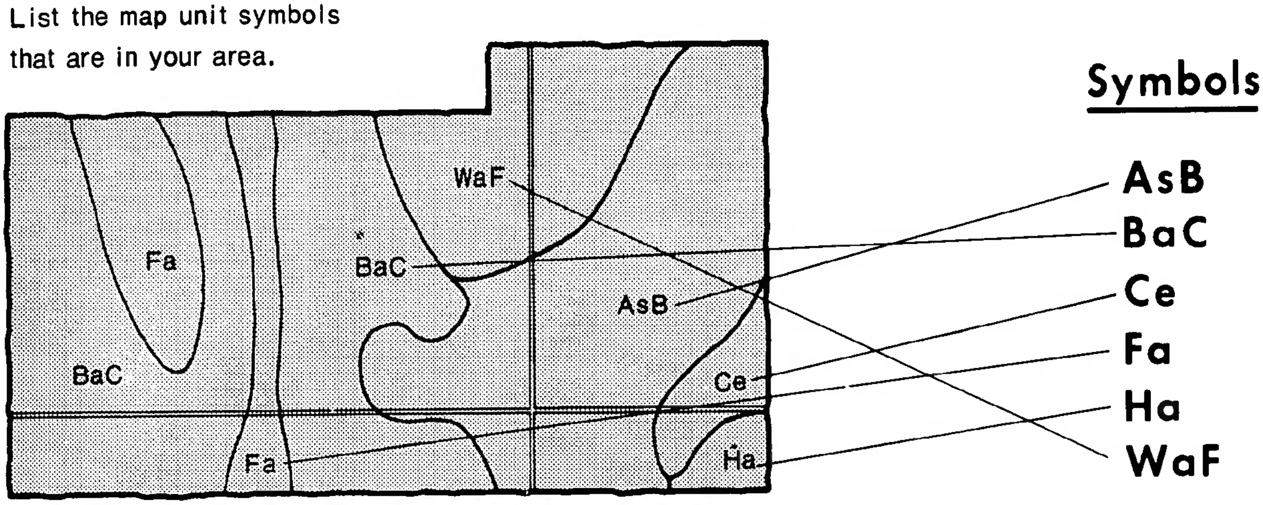
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



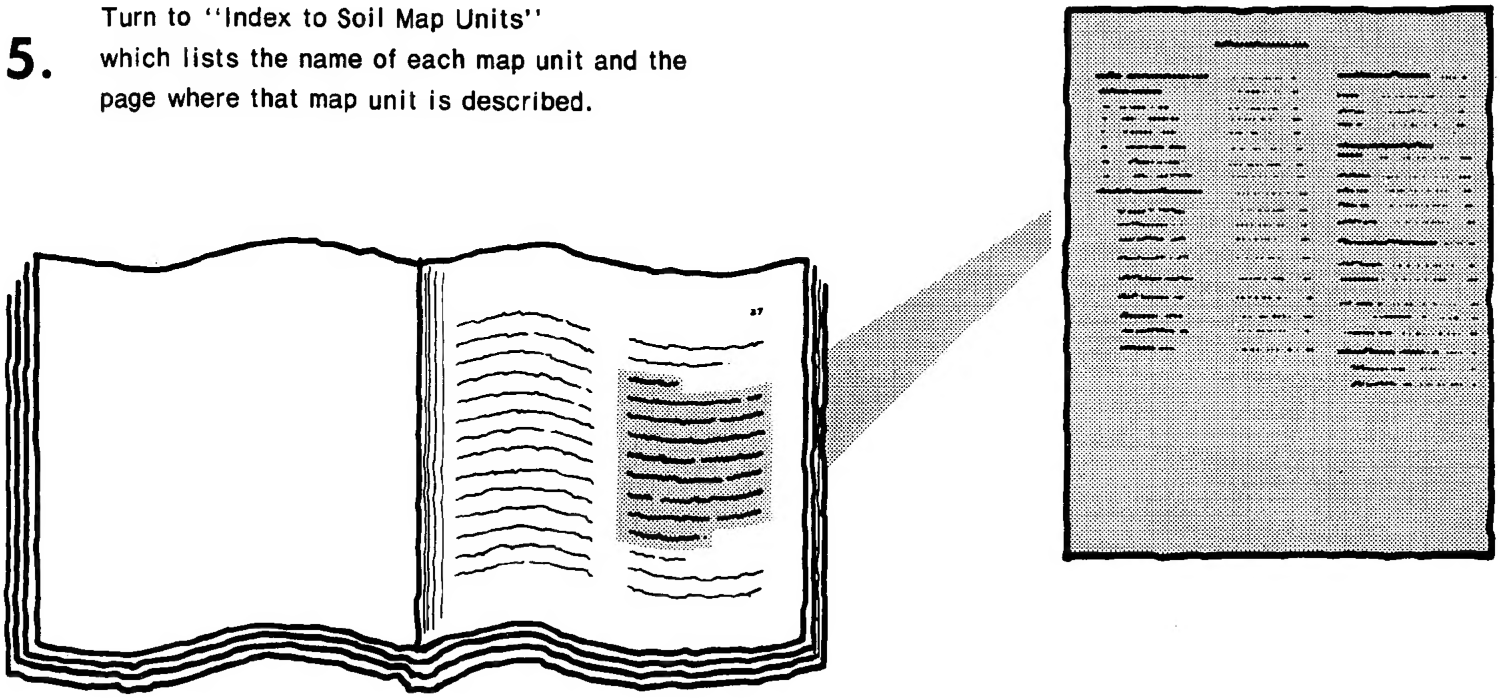


4. List the map unit symbols that are in your area.

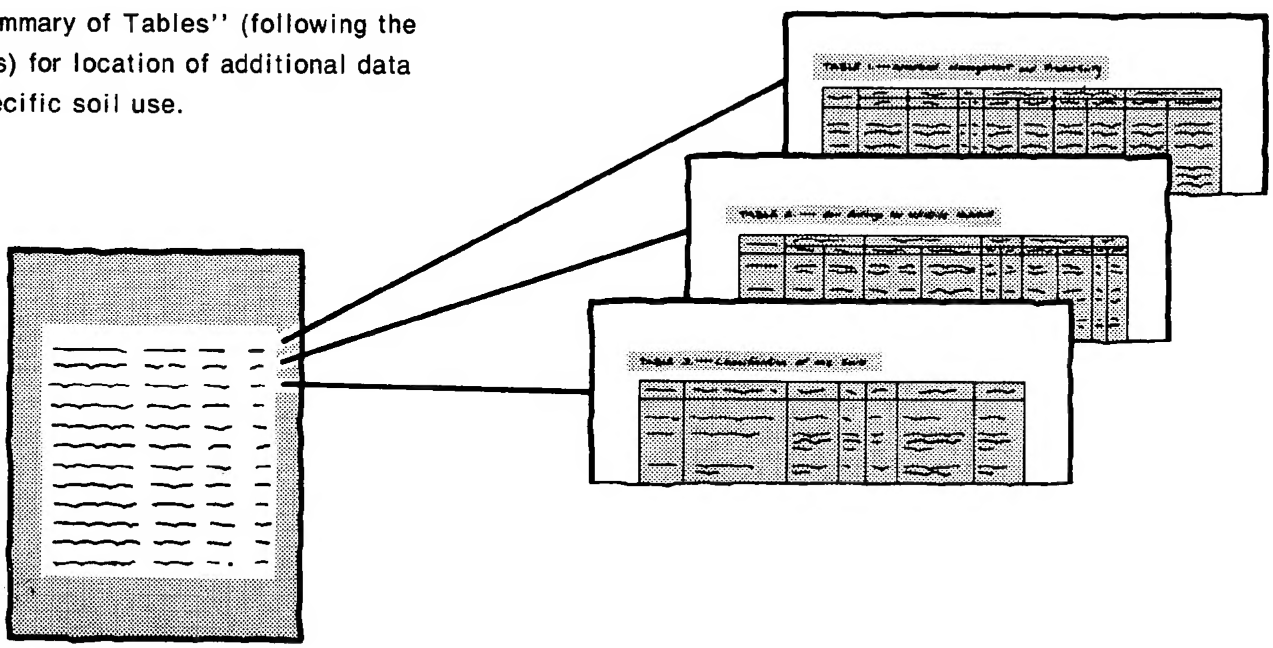


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969-76. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service, the Kentucky Department for Natural Resources and Environmental Protection, and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the McLean County Conservation District and the Muhlenberg County Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Farm pond and pasture on Loring silt loam, 6 to 12 percent slopes, severely eroded. This excellent pasture is effective in controlling erosion.

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Issued August 1980

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Foreword

The Soil Survey of McLean and Muhlenberg Counties, Kentucky contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

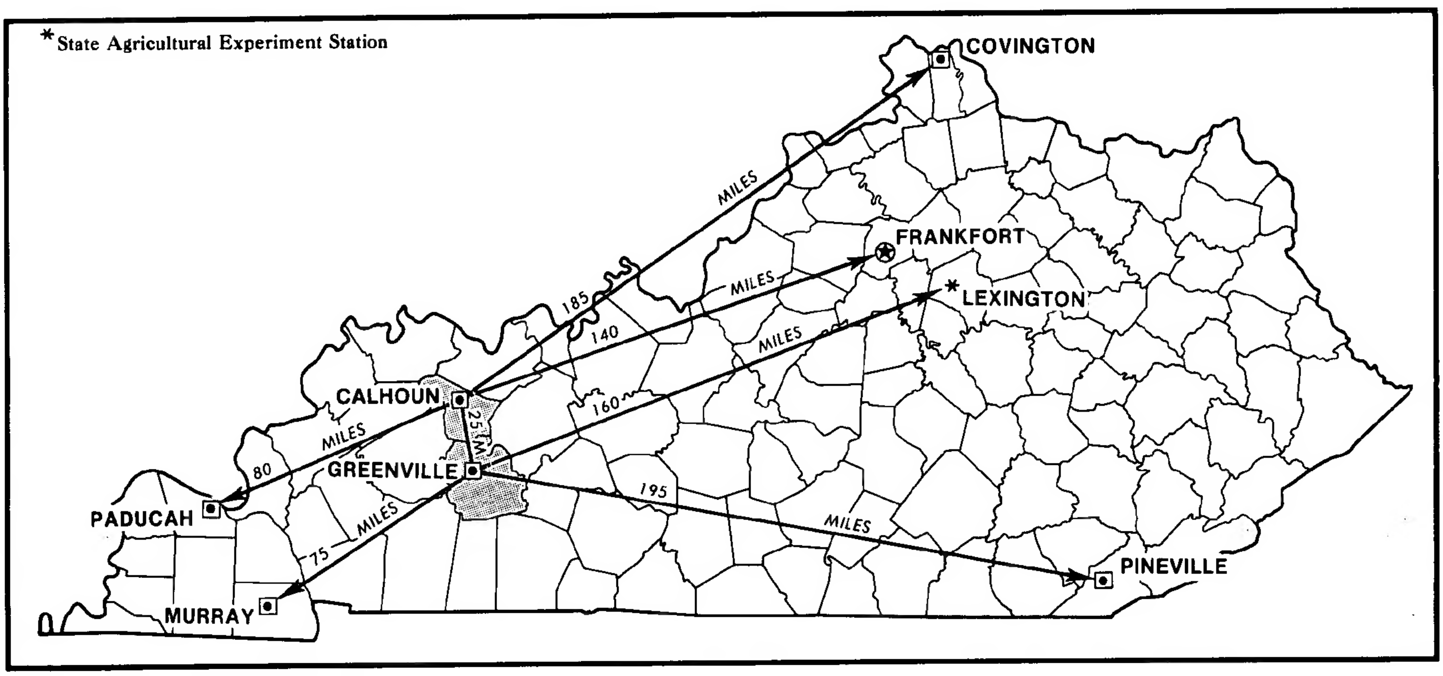
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Glen E. Murray
State Conservationist
Soil Conservation Service



Location of McLean and Muhlenberg Counties in Kentucky.

SOIL SURVEY OF MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY

By Frank R. Cox, Jr., Soil Conservation Service

Soils surveyed by Henry T. Converse, Jr., Frank R. Cox, Jr., and
Eullas H. Jacobs, Soil Conservation Service, and James E. Haagen,
Kentucky Department for Natural Resources and Environmental Protection

United States Department of Agriculture, Soil Conservation Service
in cooperation with Kentucky Department for Natural Resources,
and Environmental Protection and Kentucky Agricultural Experiment Station

MCLEAN AND MUHLENBERG COUNTIES are in the Western Coal Field Region of Kentucky (see facing page). McLean County has an area of 164,480 acres, and Muhlenberg County has an area of 307,520 acres. The largest cities in the survey area are Central City and Greenville. They both are in Muhlenberg County.

The counties are nearly level to hilly. The nearly level areas are on the flood plains of the Green River and its tributaries. The Green River flows along part of the eastern boundary of Muhlenberg County and crosses McLean County, and flows along the northwestern boundary of McLean County. The most hilly areas are in the southern part of Muhlenberg County, but small areas of hills are scattered throughout the uplands of both counties. Much of the uplands in McLean County and the northern part of Muhlenberg County are undulating or rolling.

Most of the nearly level soils are used for cultivated crops, and most of the steep soils are forested. Other soils, intermediate in slope, are cultivated, pastured, forested, or idle. Large areas, mostly in the north-central part of Muhlenberg County, have been strip mined for coal.

General nature of the area

This section provides general information about McLean and Muhlenberg Counties. It briefly describes climate, geology, relief, drainage, natural resources, transportation, markets, and farming.

Muhlenberg County was established in 1798 from Logan and Christian Counties. Its county seat is Greenville. McLean County was established in 1854 from Muhlenberg, Ohio, and Daviess Counties. Its county seat is Calhoun.

Most of the early settlers were farmers, and the counties are still largely rural. In 1970 the population of McLean County was 9,062, and the population of Muhlenberg County was 27,537. About 27 percent of the population of Muhlenberg County was urban.

The present economy is based mostly on farming and coal mining. The production of oil and gas and the manufacture of furniture, locks, clothing, potato chips, tobacco products, and lumber products also add to the economy. The world's largest steam-electric power plant, which is in Muhlenberg County, adds to the economy of the entire area.

Climate

Data for this section was obtained from the National Climatic Center, Asheville, North Carolina.

In McLean and Muhlenberg Counties, summers are hot in the valleys and slightly cooler in the hills; winters are moderately cold. Rains are fairly heavy throughout the year and are slightly heavier in winter. Snow falls nearly every winter, but the snow cover generally lasts only a few days.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Owensboro, Kentucky for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 37 degrees F, and the average daily minimum temperature is 28 degrees. The lowest temperature on record, -21 degrees, occurred at Owensboro on February 2, 1951. In summer the average temperature is 77 degrees, and the average daily maximum temperature is 89 degrees. The highest temperature, 106 degrees, was recorded on June 29, 1952.

Growing degree days, shown in Table 1, are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 22 inches, or 50 percent, generally falls during the period April through Sep-

tember, which includes the growing season for most crops. In 2 years in 10, the April-September rainfall is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4.20 inches at Owensboro on March 10, 1964. Thunderstorms number about 50 each year, 21 of which occur in summer.

Average seasonal snowfall is 12 inches. The greatest snow depth at any one time during the period of record was 13 inches. On the average, 7 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night in all seasons, and the average at dawn is about 80 percent. The percentage of possible sunshine is 75 in summer and 45 in winter. The prevailing direction of the wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in March.

Geology

McLean and Muhlenberg Counties are in the Western Coal Field physiographic region. The surface bedrock is of Pennsylvanian age, except in the southwestern part of Muhlenberg County where the surface bedrock is of Mississippian age.

The bedrock in McLean County and the northern part of Muhlenberg County is in the Lisman Formation of Upper Pennsylvanian age. The bedrock in central and southern Muhlenberg County is the Carbondale, Tradewater, and Caseyville Formations of Middle and Lower Pennsylvanian age. Formations of Pennsylvanian age are mostly sandstone, siltstone, and shale. Thin beds of limestone, coal, and clay also occur. The formations of Mississippian age are mostly limestone, sandstone, siltstone, and shale.

Relief and drainage

The relief of McLean and Muhlenberg Counties ranges from nearly level to steep. Gently sloping to steep soils of the uplands and nearly level soils on flood plains are in both counties. A higher percentage of nearly level and gently sloping soils, however, are in McLean County and a higher percentage of steep soils are in Muhlenberg County.

McLean County and the northern part of Muhlenberg County have wide flood plains and gently sloping to moderately steep soils on uplands. The gently sloping soils are commonly on narrow ridgetops and the moderately steep soils are commonly on side slopes. The southern part of Muhlenberg County has wider ridgetops, steeper side slopes, and narrower flood plains than the northern part of the survey area.

The Green River and its tributaries carry the runoff from both counties. The Green River flows along the northeast boundary of Muhlenberg County, crosses McLean County, and flows along the northwest boundary of McLean County. The Mud River, on the eastern boundary of Muhlenberg County, and the Pond River, on the western boundary of McLean and Muhlenberg Counties, are tributaries of the Green River. All three rivers flow to the north.

The valleys are widest in the northern part of the survey area. The Green River Valley in McLean County is about 5 miles wide, and the major tributaries have valleys about 1 mile wide. The small streams in both counties have narrow valleys. Most soils in the valleys are subject to flooding, but because of flood control reservoirs near the headwaters of the Green River, some soils on stream terraces nearby are infrequently flooded.

Natural resources

Coal, oil, natural gas, trees, limestone, sandstone, gravel, and water are among the natural resources in McLean and Muhlenberg Counties. At one time iron ore was also considered to be a natural resource. After the Civil War industrialists built two iron smelters in Muhlenberg County, but the smelters soon closed.

Coal is the most important revenue-producing natural resource. Muhlenberg County is the largest coal producing county in the United States. Years ago much of the coal was shaft mined from underground, but today about 80 percent of the coal is strip mined. In 1973 in Muhlenberg County 19,116,071 tons were strip mined, and 5,021,891 tons were mined from underground. In McLean County all 1,309,335 tons were mined from strip mines (*4*).

Both counties have producing oilfields and natural gas fields. Some fields have been producing oil or gas for many years, some have been producing only a few years, and some are exhausted. Oilfields outnumber gas fields, and revenue from oil production is more than revenue from gas production. In 1973, 674,967 barrels of oil were produced in the two counties (*4*) (fig. 1).

Hardwood trees are the native vegetation of the area. They are now growing mostly on wet soils and on sloping to steep soils on uplands. Bridge planks and barn patterns are made from the best logs. Chips for wood pulp, mine props, barrel staves, furniture, and pallets are made from other logs.

Limestone bedrock is near the surface in the southwestern part of Muhlenberg County, and sandstone bedrock is near the surface on uplands in both counties. Quarries supply limestone for surfacing roads, for industrial use, and for agricultural limestone. The early settlers quarried sandstone for foundations and chimneys, but most modern builders use other construction material.

Most deposits of gravel are in terraces near the edge of wide flood plains in McLean County and in the northern part of Muhlenberg County. The gravel is suitable for building roads and for industrial use. It has been used extensively in building private and secondary roads.

The Green River, the largest stream in the area, has water in sufficient quantity for navigation and for recreational and industrial use. Locks and dams make the river deep enough to be navigable at all times. The Mud River

and the Pond River have flowing water all year, but most other streams have flowing water only during wet seasons.

Limited quantities of ground water are in most parts of the survey area. In the past water was obtained by rural residents for home use from wells or cisterns; now water is piped to many parts of the area. Ponds provide water for livestock, irrigation, and recreation. Several large lakes in recreational areas have public facilities for swimming, fishing, and camping.

Transportation and markets

Paved roads are in nearly all parts of both counties. Two federal highways and several state highways cross the counties. The Western Kentucky Parkway, an east-west, four-lane toll road, crosses Muhlenberg County. Most farm products and manufactured products are taken to market and supplies are brought to farmers and local merchants by truck.

Two east-west railroads and one north-south railroad cross the counties. Coal, grain, and lumber products are sent to markets outside the counties by rail.

Locks and dams on the Green River insure a channel deep enough for navigation at all times, and coal and grain are moved down the Green River on barges.

Farm products are marketed within the counties at grain elevators at Livermore and Greenville, but most farm products are marketed in adjoining counties. Some coal is used locally, but it is mostly transported by rail, truck, or water to industrial centers outside the area. Most crude oil is piped to refineries outside the area. Manufactured products are sold in the counties and also in urban centers in other areas.

Farming

Corn, soybeans, tobacco, small grain, hay, pasture, and trees are important crops. Soybeans, tobacco, and small grain are sold as cash crops. Some corn is sold, and some is fed to hogs. Most hay and pasture are fed to beef cattle.

In 1969 there were 1,715 farms in the two counties, the average size of which was 153 acres. Three hundred and fifty-nine farmers in McLean County and 392 farmers in Muhlenberg County supplemented their incomes by working 100 days or more off the farm.

More soils are suited to intensive cultivation in the northern part of the survey area than in the southern part. The southern part has steeper soils which are more suited to woods. Soils throughout the survey area are suited to hay and pasture.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Nine map units in McLean and Muhlenberg Counties are described in the following paragraphs. The description of each unit includes a discussion of its potential for various uses.

Areas dominated by nearly level, loamy and clayey soils that are subject to flooding

The soils in this group are in valleys throughout the survey area on flood plains and stream terraces. Most of these soils are nearly level, deep, and moderately well drained to poorly drained. These soils are used mostly for cultivated crops and make up a major part of the farmland in the survey area.

1. Belknap-Waverly

Nearly level, deep, somewhat poorly drained and poorly drained, loamy soils on flood plains

Areas of these soils are on flood plains of valleys near uplands. The soils formed in alluvium that washed from upland soils that formed in loess.

This map unit makes up about 10 percent of McLean County and about 5 percent of Muhlenberg County. In McLean County, it is about 50 percent Belknap soils, 15 percent Waverly soils, and 35 percent soils of minor extent. In Muhlenberg County, it is about 46 percent Belknap soils, about 30 percent Waverly soils, and 24 percent soils of minor extent.

The Belknap and Waverly soils are silt loam throughout the profile. They are nearly level and deep, and have a seasonal high water table. Belknap soils are somewhat poorly drained, and Waverly soils are poorly drained.

The soils of minor extent are Vicksburg, Collins, Karnak, and Melvin soils on flood plains and Henshaw and McGary soils on stream terraces.

The soils in this map unit are used mainly for cultivated crops. A few areas are in woodland or pastureland or are ponded. These soils are subject to flooding. Most cultivated areas have been drained, and most undrained areas are not cultivated. On many farms in this unit the soils are used entirely for corn and soybeans.

The soils in this map unit have good potential for most cultivated crops if they are adequately drained. They have poor potential for small grain, grasses and legumes, and other crops that are damaged by flooding in winter. They have poor potential for homesites and other urban uses. Wetness is a severe limitation, and the hazard of flooding is difficult to overcome.

These soils have good potential for the development of wetland wildlife habitat. They have fair potential for intensive recreational uses because of the seasonal high water table and the hazard of flooding. They have good potential for extensive recreational uses because the soils generally are not wet and flooding does not occur during the season of use.

2. Melvin-Karnak-McGary

Nearly level, deep, somewhat poorly drained and poorly drained, loamy and clayey soils on flood plains and stream terraces

Areas of these soils are in the Green River Valley and along major tributaries of the Green River. They formed in old slackwater alluvium and in alluvium that washed from upland soils that formed in residuum derived from limestone.

This map unit makes up about 34 percent of McLean County and about 8 percent of Muhlenberg County. In McLean County, it is about 30 percent Melvin soils, about 16 percent Karnak soils, about 13 percent McGary soils, and about 41 percent soils of minor extent. In Muhlenberg County, it is about 30 percent Melvin soils, about 17 percent Karnak soils, about 12 percent McGary soils, and 41 percent soils of minor extent.

The Melvin and Karnak soils are on flood plains, and McGary soils are on stream terraces that are seldom flooded. Karnak and Melvin soils are poorly drained, and McGary soils are somewhat poorly drained. Karnak soils are clayey throughout, Melvin soils are loamy throughout, and McGary soils are loamy in the surface layer and clayey in the subsoil.

The soils of minor extent are Newark, Lindside, Nolin, and Waverly soils on flood plains and Henshaw and Markland soils on stream terraces.

The soils in this map unit are used mainly for cultivated crops. A few areas of these soils are in woodland or in pasture. Most areas of Karnak and Melvin soils, and some cultivated areas of McGary soils have been drained. On

many farms in this unit the soils are used entirely for corn and soybeans. Most farm operators live outside the area.

The soils in this map unit have good potential for most summer annual crops if they are adequately drained. They have poor potential for crops that would be damaged by flooding in winter and for such crops as tobacco and alfalfa that require a well drained soil. They have poor potential for homesites and other urban uses. Wetness is a severe limitation and is difficult to overcome. Soils in this map unit have good potential for the development of wildlife habitat. They have poor potential for intensive recreational uses because of the seasonal high water table and the hazard of flooding. They also have good potential for extensive recreational uses.

3. Newark-Otwell-Melvin

Nearly level and gently sloping, deep, moderately well drained to poorly drained, loamy soils on flood plains and stream terraces

Areas of these soils are in the Green River Valley in a band that roughly parallels the river. The soils formed in alluvium that was deposited by the Green River.

This map unit makes up about 11 percent of McLean County and about 3 percent of Muhlenberg County. In McLean County, it is about 18 percent Newark soils, about 14 percent Otwell soils, about 14 percent Melvin soils, and 54 percent soils of minor extent. In Muhlenberg County, it is about 22 percent Newark soils, about 9 percent Otwell soils, about 9 percent Melvin soils, and 60 percent soils of minor extent.

The Otwell soils are on stream terraces and are slightly higher in elevation than Newark and Melvin soils which are on flood plains (fig. 2). Otwell soils are moderately well drained and have a fragipan. Newark soils are somewhat poorly drained, and Melvin soils are poorly drained. All of the soils in this unit have a surface layer of silt loam, a subsoil of silt loam or silty clay loam, and a seasonal high water table.

The soils of minor extent are Elk and Weinbach soils on stream terraces and Nolin and Lindside soils on flood plains.

The soils in this map unit are used mainly for cultivated crops, hay, and pasture. On many farms the soils are used entirely for corn and soybeans. In some places the farm buildings are on stream terraces, and in some places the farm buildings are outside the map unit. A few small areas are in woodland.

These soils have good potential for some cultivated crops if the wet soils have been drained. They have poor potential for crops that are damaged by flooding in winter. A few small areas of soils are subject to erosion. These soils have fair potential for urban uses because of wetness and the hazard of flooding. Some areas near the river have good potential for recreational uses in summer when flooding generally does not occur.

Areas dominated by nearly level to steep, loamy soils on uplands

The soils in this group are on uplands throughout the survey area. They formed in loess, in residuum, or in loess and residuum. The residuum was derived from sandstone, siltstone, shale, or limestone. The soils are gently sloping to steep, moderately deep and deep, and well drained and moderately well drained. They are used for farming, and in some large areas they are in woodland. Most urban land and built-up land in the survey area are on these soils.

4. Loring-Wellston

Gently sloping to steep, deep, moderately well drained and well drained, loamy soils on hilltops and side slopes

Areas of these soils are on uplands throughout McLean County and in the northern part of Muhlenberg County. The soils formed in loess or in loess and underlying residuum.

This map unit makes up about 27 percent of McLean County and 5 percent of Muhlenberg County. In both counties it is about 25 percent Loring soils, about 24 percent Wellston soils, and 51 percent soils of minor extent.

The Loring soils formed in loess and are on hilltops and side slopes. They are moderately well drained and gently sloping to moderately steep and have a fragipan. Wellston soils formed in loess and the underlying residuum and are on side slopes (fig. 3). They are well drained and gently sloping to steep and do not have a fragipan. Both of these soils have a surface layer of silt loam and a subsoil of silt loam or silty clay loam.

The soils of minor extent are Memphis, Grenada, Zanesville, Frondorf, and Lenberg soils on uplands and Collins, Belknap, and Waverly soils on flood plains.

These soils are used mainly for farming. Some of the crops are pasture, hay, and woodland crops. A large acreage of the unit previously was used for cultivated crops but is now used for trees or brush. Cultivated crops are mainly on gently sloping and sloping soils and soils on flood plains. Woodland is mainly on moderately steep and steep soils. Hay and pasture are on all of the soils in the unit. The major soils in this unit are subject to erosion. The gently sloping and sloping soils can be used for cultivated crops if they are protected from erosion. Most soils on hilltops have good potential for corn, tobacco, hay, and pasture. Many farm buildings are on the Loring soils on hilltops. The Loring and Wellston soils on side slopes have good potential for hay, pasture, and woodland and for habitat for openland and woodland wildlife.

These soils have fair potential for urban uses. The hazard of erosion and slow permeability in the fragipan are limitations of Loring soils for some urban uses. These soils have fair potential for intensive recreational uses and good potential for extensive recreational uses.

5. Grenada-Loring

Gently sloping to moderately steep, deep, moderately well drained, loamy soils mainly on wide ridgetops

Areas of these soils are on uplands throughout McLean County and in the northern part of Muhlenberg County. The soils formed in loess.

This map unit makes up 17 percent of McLean County and about 4 percent of Muhlenberg County. In McLean County, it is about 35 percent Grenada soils, about 18 percent Loring soils, and 47 percent soils of minor extent. In Muhlenberg County, it is about 40 percent Grenada soils, about 12 percent Loring soils, and 48 percent soils of minor extent.

The Grenada and Loring soils are moderately well drained and have a fragipan. Grenada soils are nearly level and gently sloping and are mainly on wide ridgetops. Loring soils are gently sloping and sloping and are on narrow ridgetops and on side slopes. Both of these soils have a surface layer of silt loam and a subsoil of silt loam or silty clay loam.

The soils of minor extent are Calloway, Wellston, Frondorf, and Lenberg soils on uplands and Collins, Belknap, and Waverly soils on flood plains.

These soil are used mainly for farming. Some of the crops are corn, soybeans, wheat, tobacco, hay, and pasture. On some farms the soils are used entirely for cultivated crops; on other farms they are used for cultivated crops and sod crops. A few small areas are in woodland. Many farms have soils both on uplands and on flood plains. On most farms the farm buildings are on uplands.

The soils in this map unit have good potential for farming. The gently sloping and sloping soils are subject to erosion, and erosion control practices are needed if the soils are used for cultivated crops. The fragipan in these soils restricts water movement and root development, and some deep-rooted crops die out within a few years. The soils have good potential for most urban uses. Slow permeability in the fragipan and slope are limitations for some urban uses. These soils have good potential for the development of wildlife habitat. Most of the soils have good potential for intensive and extensive recreational uses.

6. Udorthents-Zanesville-Wellston

Gently sloping to steep, deep, well drained soils in strip mine areas and gently sloping to steep, moderately well drained and well drained loamy soils on hilltops and side slopes

Areas of these soils are mainly in the northern part of Muhlenberg County, but some areas are in other parts of the survey area. The map unit consists of soils that have been moved in the strip mining of coal, and the adjacent soils.

This map unit makes up about 1 percent of McLean County, and 20 percent of Muhlenberg County. In both counties, it is about 48 percent Udorthents, about 13 percent Zanesville soils, about 9 percent Wellston soils, and 30 percent soils of minor extent.

The Udorthents are in strip mine spoil, and Zanesville and Wellston soils formed in loess and the underlying residuum. Udorthents are deep and well drained and are variable in texture and in slope. Zanesville soils are moderately well drained and well drained, and are mainly on hilltops and have a fragipan. Wellston soils are well drained and are mostly on side slopes and do not have a fragipan. Both Zanesville and Wellston soils have a surface layer of silt loam and a subsoil of silt loam or silty clay loam.

The soils of minor extent are Frondorf, Lenberg, Memphis, and Loring soils on uplands and Belknap and Waverly soils on flood plains. Most Dumps in the survey area are in this map unit. Several bodies of water are in this unit.

This map unit is mainly made up of areas that are used mostly for coal mining. Many areas of soils that have not been strip mined grow trees, brush, and natural vegetation. Areas that have been strip mined grow trees, grasses and legumes, natural vegetation, and vegetation used for wildlife habitat (fig. 4). Houses along highways that cross the area are on soils that have not been strip mined. Several large coal mines are still in operation.

The soils in this map unit have poor potential for farming. They are subject to erosion, and Udorthents have rock fragments. Most of the soils have poor potential for most urban uses. They have good potential for the development of wildlife habitat. The soils have fair potential for intensive recreational uses and good potential for extensive recreational uses.

7. Zanesville-Wellston-Frondorf

Gently sloping to steep, moderately deep and deep, moderately well drained and well drained, loamy soils on narrow hilltops and on side slopes

A large area of these soils is in the southern part of Muhlenberg County and several small areas of these soils are in other parts of the county. The soils formed in thin loess and underlying residuum derived from sandstone and siltstone.

This map unit makes up about 43 percent of Muhlenberg County. It is about 26 percent Zanesville soils, about 21 percent Wellston soils, about 14 percent Frondorf soils, and 39 percent soils of minor extent.

The Zanesville soils are mainly on hilltops, and Wellston and Frondorf soils are on side slopes (fig. 5). Zanesville soils are gently sloping and sloping, deep, moderately well drained and well drained, and have a fragipan. Wellston soils are gently sloping to steep, deep, and well drained. Frondorf soils are moderately steep and steep, moderately deep, and well drained. All of these soils have a surface layer of silt loam and a subsoil of silt loam or silty clay loam.

The soils of minor extent are Lenberg, Sadler, Caneyville, Calloway, and Loring soils and Udorthents on uplands and Clifty, Vicksburg, Collins, Belknap, and Waverly soils on flood plains. Outcrops of rock are on some steep slopes.

Most of the soils in this map unit are in permanent vegetation. Soils that are farmed are mainly on hilltops and in valleys. These soils are used for cultivated crops, hay, and pasture. Some farmland has been abandoned, and native vegetation is returning to these areas. The steep soils are mainly in woodland. Lake Malone State Park is in this map unit.

Most of these soils have poor potential for farming; however, some soils have good potential for farming. They are mainly in small areas on narrow hilltops or in valleys. Many soils in this unit have poor potential for homesites and urban uses. Slow permeability of the fragipan, steep slopes, or moderate depth to bedrock are limitations. These soils have poor potential for wetland wildlife habitat, fair potential for openland wildlife habitat, and good potential for woodland wildlife habitat. They have fair potential for intensive recreational uses and good potential for extensive recreational uses.

8. Sadler-Zanesville-Wellston

Nearly level to moderately steep, deep, moderately well drained and well drained, loamy soils on wide hilltops and on side slopes

Areas of these soils are in the southern part of Muhlenberg County. The soils are mainly on wide hilltops. They formed in loess and underlying residuum derived from sandstone and siltstone.

This map unit makes up about 7 percent of Muhlenberg County. It is about 26 percent Sadler soils, about 16 percent Zanesville soils, about 15 percent Wellston soils, and 43 percent soils of minor extent.

The Sadler and Zanesville soils are on wide hilltops, and Wellston soils are on side slopes (fig. 6). Sadler and Zanesville soils have a fragipan. Sadler soils are nearly level and gently sloping, Zanesville soils are gently sloping and sloping, and Wellston soils are sloping and moderately steep. All of these soils are deep and have a surface layer of silt loam and a subsoil of silt loam or silty clay loam.

The soils of minor extent are Calloway, Frondorf, and Lenberg soils on uplands and Collins, Belknap, and Waverly soils on flood plains.

These soils are used mainly for farming. Some of the crops are corn, tobacco, hay, and pasture. Most farm operators live on the farm, and farm buildings are on these soils. A few areas of soils are in woodland.

These soils have good potential for farming. They are subject to erosion, and conservation practices are needed if the soils are used for cultivated crops. These soils have fair potential for homesites and urban uses. Slow permeability in the fragipan and slope are limitations. Most of the soils in this map unit have good potential for the development of openland and woodland wildlife habitats. The soils have fair potential for intensive recreational uses and good potential for extensive recreational uses.

9. Caneyville-Zanesville-Frondorf

Gently sloping to steep, moderately deep and deep, moderately well drained and well drained, loamy soils on narrow hilltops and on side slopes

An area of these soils is in the southwestern part of Muhlenberg County. The soils on hilltops formed in loess and underlying residuum derived from sandstone. The soils on side slopes formed in residuum derived from limestone and in thin loess and the underlying residuum derived from sandstone and siltstone.

This map unit makes up about 5 percent of Muhlenberg County. It is about 26 percent Caneyville soils, about 19 percent Zanesville soils, about 15 percent Frondorf soils, and 40 percent soils of minor extent.

The Caneyville soils formed in residuum derived from limestone, and Zanesville and Frondorf soils formed in loess and underlying residuum derived from sandstone and siltstone (fig. 7). Caneyville soils are sloping to steep, moderately deep, and well drained. They are on side slopes and many areas have outcrops of rock. Zanesville soils are gently sloping and sloping, deep, and moderately well drained to well drained. They are mainly on hilltops. Frondorf soils are moderately steep and steep, moderately deep, and well drained. They are on side slopes. All of these soils have a surface layer of silt loam. Caneyville soils have a subsoil of silty clay or clay, and Zanesville and Frondorf soils have a subsoil of silt loam or silty clay loam.

The soils of minor extent are Lenberg, Wellston, Sadler, and Calloway soils on uplands and Nolin, Lindside, Newark, Melvin, and Clifty soils on flood plains.

These soils are nearly level and gently sloping and are mainly in cultivated crops. The steep soils are mainly in woodland. Other soils in the unit are in cultivated crops, hay, and pasture. A few areas of farmland have been abandoned, and native vegetation is returning to these areas. Most farms are on hillsides or in valleys.

The soils in this map unit have poor potential for farming. Small areas of these soils have good potential for cultivated crops, but the large areas are better suited to woodland. Most of the soils in this unit have poor potential for most urban uses because of slope, depth, slow permeability, and outcrops of rock. The soils have poor potential for the development of wetland wildlife habitat and fair potential for other kinds of wildlife habitat. They have fair potential for recreational uses.

Broad land use considerations

The survey area is mostly rural, but urban centers are in the area. Most of the soils that are well suited to farming are used for farming, but every year more land is taken for

urban uses and for recreational purposes. Because of this competition for use of the good soils, planning is needed to determine the better uses of the soils. The General Soil Map is useful in planning broad use of the land. It cannot be used for the selection of specific sites for a particular use. For the selection of specific sites, the section "Soil maps for detailed planning" and the section "Use and management of the soils" are useful.

In this survey area the soils on flood plains and terraces are intensively farmed. They generally have good potential for farming if they have been drained. Most of these alluvial soils have a seasonal high water table and are subject to flooding, mostly in the winter and spring. These soils have good potential for the cultivation of row crops (fig. 8). They have good potential for corn, soybeans, and summer annuals that do not require a well drained soil. The Belknap-Waverly map unit is in narrow valleys near the uplands; the Melvin-Karnak-McGary map unit and the Newark-Otwell-Melvin map unit are mainly in the Green River Valley. Flooding by the Green River lasts longer than flooding by the smaller streams. In some places, wheat, grasses, legumes, and other crops that grow in winter are damaged by flooding on the alluvial soils. Erosion is not a hazard.

The soils on uplands are subject to erosion, but not to flooding. The soils in the Grenada-Loring map unit have good potential for farming; many of these soils are adjacent to alluvial soils. The soils in the Sadler-Zanesville-Wellston map unit have good potential for farming, but are not so intensively cultivated as the soils in the Grenada-Loring unit because they are adjacent to soils that do not have good potential for farming. Generally, the other soils on uplands have fair to poor potential for farming, but a few small tracts are suited to farming. Many of the soils in these other map units have steep slopes and outcrops of rock, and they have a hazard of erosion. The soils that have good potential for farming are more widespread in the northern part than in the southern part of the survey area.

The soils on flood plains and terraces generally have poor potential for urban development because of the hazard of flooding and the seasonal high water table. However, these nearly level alluvial soils are not entirely unsuitable for urban uses. In some places, flooding is not a serious problem and the cost of preventive measures is not prohibitive; and the water table can be lowered by drainage. Soils in the Newark-Otwell-Melvin map unit that are on stream terraces are rarely flooded; flooding by the Green River, however, is damaging because the water stands for several days, or even several weeks.

The soils on uplands can be used for urban purposes, but most of these soils have some limitations. The gently sloping soils in the Grenada-Loring and Sadler-Zanesville-Wellston map units have severe limitations for septic tank filter fields because of slow permeability of the fragipan. The other map units on uplands have sloping to steep soils that have poor potential for urban uses because of slope or moderate depth to bedrock. Most of the gently sloping soils in these map units have limitations for some urban uses because of slow permeability of the fragipan.

Soils throughout the survey area can be used for recreational purposes. Most soils on uplands have good potential for both intensive and extensive recreational uses; however, some soils in hilly parts of the survey area have poor potential for intensive recreational uses because of slope or depth to bedrock. The soils on flood plains and terraces have good potential for extensive recreational uses and fair potential for intensive recreational uses. These soils are limited because of the seasonal high water table and the hazard of flooding, but wetness and flooding generally do not occur during the period of use. Many valleys are suitable for impounding water, and some valleys in the southern part of the area can be used to build dams that will form lakes several hundred acres in size; for example, Lake Malone in Muhlenberg County (fig. 9). Many soils that are adjacent to these valleys are suited to recreational uses. Soils that have been strip mined for coal, mostly in the northern part of Muhlenberg County, have good potential for extensive recreational uses. In places, these soils are suited to recreational uses because they have poor potential for other uses, have few homesites, and are near centers of population.

Soils that have been strip mined have good potential as habitat for some kinds of wildlife, because they are not used as homesites, or for farming or urban purposes, and wildlife are relatively undisturbed. Other soils throughout the survey area also provide food and cover for wildlife. Most soils that formed in alluvium have good potential as habitat for wetland wildlife. Soils on uplands have fair or good potential for openland wildlife or woodland wildlife. Steep soils are better suited to growing trees than to many other uses, and these soils provide cover for wildlife as well as furnish timber products.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Wellston silt loam, 2 to 6 percent slopes, is one of several phases within the Wellston series.

Some map units are made up of two or more dominant kinds of soil. Such map units in this survey area are called soil complexes and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Frondorf-Lenburg complex, 12 to 20 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Markland soils, 12 to 35 percent slopes, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Be—Belknap silt loam. This deep, nearly level, somewhat poorly drained soil is on flood plains. It formed in alluvium that washed from nearby uplands. The mapped areas are mostly 200 to 1,000 feet wide and 1/4 mile to 3 miles long. Most areas extend across the entire valley.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 36 inches. The upper part is brown silt loam to a depth of 12 inches; the lower part is light brownish gray and gray silt loam that has mottles in shades of brown to a depth of 36 inches. The substratum, to a depth of 60 inches, is gray silt loam that has mottles of yellowish brown and very dark grayish brown.

Included with this soil in mapping are a few areas of Vicksburg, Collins, and Waverly soils. Also included are a soil that has more sand throughout than the Belknap soil, a soil that has more clay in the subsoil, a soil that is stratified, and a soil that is less acid in the subsoil than this Belknap soil. A soil, mainly in the southern part of the survey area, that is 5 to 15 percent pebbles in the surface layer and subsoil is also included. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate, and runoff is slow. Available water capacity is high. Organic-matter content is low, and the root zone is deep except when it is limited by the seasonal high water table of this soil. The soil is strongly acid or very strongly acid unless limed. It is subject to flooding and has low strength.

The Belknap soil has good potential for most summer annuals. It is not subject to erosion and is suited to intensive use for cultivated crops. Flooding occurs mostly in winter and spring and limits the use of some areas for perennial plants. The seasonal high water table limits the suitability of this soil for some plants and delays planting in some years. If adequately drained, this soil is suited to most crops grown in the survey area. Most crops respond well to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. Use of cover crops and return of crop residue to the soil are practices that increase the content of organic matter and improve workability of the soil.

This soil has good potential for most hay and pasture plants that are grown in the area, but the seasonal high water table and the hazard of flooding are limitations. Use of the proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and rotation of pasture are the main management needs.

This soil has good potential for trees. Many species grow well on this soil. Competition from undesirable species can be controlled by site preparation, spraying, cutting, or girdling. Most trees are harvested in summer or fall because the use of equipment is limited in wet periods. Erosion generally is not a problem.

This soil has poor potential for most urban uses because of the seasonal high water table and hazard of flooding. In most winters, the subsoil is saturated with water for several weeks. Ditches and tile drains can be used to remove excess water but may not be practical for such uses as buildings with basements and septic tank absorption fields. In some years flooding occurs in winter or early in spring. Permanent urban structures can be protected from flooding by dikes and levees. In some places, the hazard of flooding is slight and cost of protection is low. This soil is suited to most recreational purposes that are restricted to dry periods. Capability subclass IIw; woodland ordination symbol 2w.

Ca—Calloway silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on wide ridgetops and near the base of slopes on uplands. The mapped areas are mostly 400 to 800 feet in diameter and roughly circular in shape.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 65 inches. The upper part is yellowish brown and light brownish gray silt loam that has grayish and brownish mottles and extends to a depth of 24 inches. The lower part is a firm, brittle, and compact silt loam fragipan that is gray and light gray with shades of gray and brown mottles and extends to a depth of 65 inches.

Included with this soil in mapping are small areas of Grenada soils and small areas of a poorly drained soil. Also included, in the southern part of the survey area, is a soil that is 3 to 4 feet deep to bedrock. The included soils make up about 10 to 20 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is slow. Available water capacity is moderate, and the root zone is moderately deep to the fragipan. Organic-matter content is low. The soil is strongly acid or very strongly acid unless limed. It has good tilth and workability. It has a seasonal high water table perched above the fragipan and has low strength.

This soil has fair potential for cultivated crops. The erosion hazard is slight, and the soil can be cultivated in short rotation without significant loss of soil. It is not well suited to crops that require a well drained soil because of the seasonal high water table. Deep rooted plants die within a few years because of the moderately deep root zone. The soil can be worked within a wide range of moisture content without crusting or clodding. Crops respond well to applications of lime and fertilizer. Most row crops that are common in the area can be grown on this soil; however, drainage improves the suitability of some crops. The use of cover crops and return of crop residue to the soil helps increase the supply of organic matter and improve the tilth.

This soil has good potential for most grasses and legumes that are common to the area, but it is not well suited to plants that require a deep, well drained soil because of the moderately deep root zone and the seasonal high water table. Most plants grow best where the excess water has been removed. The use of proper seeding rates, application of lime and fertilizer, control of grazing, and control of weeds are important management needs.

This soil has good potential for trees. Excess water during wet periods limits the use of equipment. This soil is limited by plant competition from undesirable species.

This soil has poor potential for most urban uses because of the seasonal high water table. In most winters, the subsoil above the fragipan is saturated with water for several weeks. Excess water can be removed by ditches, but in some areas this is not always practical. Slow permeability in the fragipan limits the use of tile drains and septic tank filter fields. This soil is suited to uses that are restricted to short periods of time in dry periods. Capability subclass IIIw; woodland ordination symbol 2w.

CcC—Caneyville silt loam, 6 to 12 percent slopes. This moderately deep, sloping, well drained soil is on hillsides mainly in the southwestern part of Muhlenberg County. Most mapped areas are 200 to 500 feet wide and extend 1,000 to 2,000 feet around the hill. Outcrops of limestone cover less than 2 percent of the surface in some areas.

Typically, the surface layer is silt loam about 5 inches thick. It is very dark grayish brown in the upper part and yellowish brown in the lower part. The subsoil extends to a depth of 30 inches. It is yellowish red clay in the upper part and light yellowish brown clay in the lower part and has brownish and reddish mottles. Limestone bedrock is below a depth of 30 inches.

Included with this soil in mapping are small areas of Lenberg, Wellston, and Frondorf soils. Severely eroded areas of Caneyville soils are in a few places. Also included are a soil that has gray mottles in the upper part of the subsoil, a soil that is not so deep to bedrock as the Caneyville soil, and a soil that is deeper to bedrock. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderately slow. Available water capacity is moderate. The root zone is moderately deep. Organic-matter content is low to moderate, and natural fertility is medium. The soil is medium acid to very strongly acid unless limed. The clayey subsoil has a tendency to shrink and swell. This soil has low strength.

This soil has fair potential for cultivated crops because the erosion hazard is very severe; however, crops can be grown if intensive erosion control measures are used. This soil is suited to most crops that are grown in the area. It can be worked within a wide range of moisture content without crusting and clodding except in areas where the clayey subsoil has been exposed by erosion.

This soil has good potential for most hay and pasture plants that are grown in the area. Contour cultivation, the use of proper seeding rates, application of lime and fertilizer, control of grazing, and control of weeds are the main management needs.

This soil has fair potential for trees, and some areas are in native hardwoods. The rate of seedling mortality is the main concern in management.

This soil has poor potential for most urban uses because of depth to bedrock, slope, and clayey texture of the subsoil. Bedrock at a depth of 20 to 40 inches and excessive slope are severe limitations. Deep excavation and considerable cutting and filling are needed for such structures as large buildings. The moderate shrink-swell potential and low strength of the soil are limitations, but they can be overcome by good design and careful installation. The moderately slow permeability is a limitation for septic tank filter fields, but this limitation can be overcome by increasing the size of or by modifying the filter field. The included deeper soil is better suited to most urban uses than this Caneyville soil. Capability subclass IVe; woodland ordination symbol 3c.

CcD—Caneyville silt loam, 12 to 20 percent slopes. This moderately deep, moderately steep, well drained soil is on hillsides mainly in the southwestern part of Muhlenberg County. Most areas are 200 to 500 feet wide and extend 1,000 to 2,000 feet around the hill. Outcrops of limestone cover less than 2 percent of the surface in some areas.

Typically, the surface layer is silt loam about 5 inches thick. It is very dark grayish brown in the upper part and yellowish brown in the lower part. The subsoil extends to a depth of 30 inches. It is yellowish red clay in the upper part and light yellowish brown clay in the lower part and has brownish and reddish mottles. Limestone bedrock is below a depth of 30 inches.

Included with this soil in mapping are small areas of Lenberg, Wellston, and Frondorf soils. Severely eroded areas of Caneyville soils are in a few places. A soil that is not so deep to bedrock as the Caneyville soil and a soil that is deeper to bedrock are also included. The included soils make up 20 to 30 percent of this map unit.

Permeability is moderately slow. Available water capacity is moderate, and the root zone is moderately deep. Organic-matter content is low to moderate, and natural fertility is medium. The soil is medium acid to very strongly acid unless limed. The clayey subsoil has a tendency to shrink and swell. The soil is moderately deep to bedrock. It has low strength.

This soil has poor potential for cultivated crops. Most crops that are common in the area grow well on this soil; however, the severe erosion hazard makes this soil generally unsuited to cultivation.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding rates and mixtures, contour cultivation, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs. Overgrazing of pasture and frequent renovation generally result in erosion.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil. Potential productivity is higher on north-facing slopes than on south-facing slopes. Because of moderately steep slopes, use of equipment is limited and erosion is a problem during harvest of timber products. The rate of seedling mortality is a concern in management.

This soil has poor potential for most urban uses because of depth of bedrock, slope, and the clayey texture of the subsoil. Cutting and filling are needed for many uses because of the slope, but bedrock at a depth of 20 to 40 inches restricts deep cuts except in areas where the bedrock can be excavated. The moderate shrink-swell potential and low strength of this soil are limitations, but these limitations can be overcome by good design and careful installation. The included deeper soil is better suited than this Caneyville soil to some urban uses. Capability subclass VIe; woodland ordination symbols: north aspect 2c, south aspect 3c.

CdE—Caneyville-Rock outcrop complex, 12 to 30 percent slopes. This complex consists of small areas of Caneyville soils and Rock outcrop that are so intermingled that they could not be separated at the scale used in mapping. These soils are on hillsides and are dissected by deep drainageways. Most areas are 200 to 600 feet wide and extend 2,000 to 5,000 feet around the hill. The complex is downslope from soils that formed in residuum derived from sandstone, siltstone, and shale. The outcrops of rock are limestone, and the Caneyville soils formed in residuum derived from limestone.

The Caneyville soil makes up about 50 percent of the map unit. Typically, the surface layer is silt loam about 5 inches thick. It is very dark grayish brown in the upper part and yellowish brown in the lower part. The subsoil is clay and extends to a depth of 30 inches. It is yellowish red in the upper part and light yellowish brown in the lower part and has brownish and reddish mottles. Limestone bedrock is at a depth of 30 inches.

In the Caneyville soil, permeability is moderately slow, and available water capacity is moderate. The root zone is moderately deep. Organic-matter content is low to moderate, and natural fertility is medium. The Caneyville soil is medium acid to very strongly acid unless limed. The clayey subsoil has a tendency to shrink and swell. This soil has low strength.

Rock outcrop makes up about 20 percent of the map unit. It consists of exposures of limestone bedrock in the form of ledges, boulders, and escarpments. Ledges and boulders are mainly 3 to 10 feet in diameter. Escarpments are 5 to 15 feet high and extend 100 to 500 feet around the hill.

Included with this complex in mapping are small areas of Lenberg and Wellston soils, soils that are less deep to bedrock or deeper to bedrock than the Caneyville soil, soils that have more clay in the surface layer, and a soil that has a high content of coarse fragments in the surface layer. Also included are small areas of severely eroded Caneyville soils.

This complex has poor potential for cultivated crops, because of steep slopes and the presence of outcrops of rock. In most areas it has poor potential for pasture because of difficulty in mowing and in renovating the pasture. The hazard of erosion is very severe. The Caneyville soil is suited to permanent vegetation. In areas that can be seeded and maintained, it is suited to most grasses and legumes grown in the area. Crops respond well to the application of lime and fertilizer.

The Caneyville soil in this complex has fair potential for trees, and most areas of the complex are in woodland. Trees that grow well on well drained soils on uplands have average growth on this soil. Outcrops of rock and steep slopes interfere with the use of harvesting equipment. Erosion is probable on haul roads and skidtrails. The rate of seedling mortality is a concern in woodland management.

This complex has poor potential for most urban uses because of depth to bedrock, slope, clayey texture of the subsoil, and the presence of rock outcrops. Steep slopes are a severe limitation for most uses. Bedrock is at a depth of 20 to 40 inches in the Caneyville soil and is exposed at the surface in the Rock outcrop part of the complex. Considerable cutting and filling are needed for buildings because of steep slopes, but excavating and cutting are severely limited by the bedrock. Moderate shrink-swell potential and low strength of the soil are also limitations, but they can be overcome by good design and careful installation. Capability subclass VIIs; woodland ordination symbols: north aspect 2c, south aspect 3c.

Cg—Clifty gravelly silt loam. This deep, nearly level, well drained soil is on flood plains in narrow valleys and near steep soils on uplands. Most areas of this soil are in Muhlenberg County. The mapped areas are mainly 200 to 1,000 feet wide and 1,000 to 5,000 feet long, and are about 5 to 25 acres in size.

Typically, the surface layer is brown gravelly silt loam about 8 inches thick. The subsoil is brown gravelly silt loam and extends to a depth of 26 inches. The substratum is brown gravelly silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Vicksburg, Collins, and Belknap soils. Also included are small areas of moderately well drained and somewhat poorly drained gravelly soils and a soil that is 35 to 50 percent gravel in the subsoil. The included soils make up 15 to 25 percent of the map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate, and the root zone is deep. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It is subject to flooding.

This soil has good potential for cultivated crops. The hazard of erosion is slight, and this soil can be cultivated in short rotations without loss of soil. Flooding is mostly of short duration and occurs in winter or spring when row crops are not growing. Most crops respond to the application of lime and fertilizer. Coarse fragments in the plow layer interfere with tillage in some places. The use of cover crops and return of residue to the soil increase the content of organic matter and improve the tilth.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area; however, in some years perennials are damaged by flooding in winter and spring. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and rotation of pasture are the main management needs.

This soil has good potential for trees. Most trees that are common to the area grow well on this soil. Competition from undesirable species can be controlled by site preparation, spraying, cutting, or girdling. Erosion generally is not a problem.

This soil has poor potential for many urban uses because of the hazard of flooding. In most years flooding occurs in winter and spring but is of short duration. This hazard can be overcome by the use of dikes or levees, but the cost is high. Moderately rapid permeability permits seepage if this soil is used for sanitary facilities. Coarse fragments interfere with some uses in areas of foot traffic. Capability subclass IIs; woodland ordination symbol 1o.

Co—Collins silt loam. This deep, nearly level, moderately well drained soil is on flood plains. It formed in alluvium that washed from nearby uplands. Most areas of this soil are 200 to 400 feet wide and 500 to 2,000 feet long, and are about 10 to 30 acres in size. They are near the base of hills, in narrow strips near large streams, or in narrow valleys in areas of hills.

Typically, the surface layer is dark yellowish brown silt loam about 9 inches thick. The subsoil extends to a depth of 32 inches. The upper part is brown silt loam to a depth of 18 inches; the lower part is mottled light brownish gray and dark yellowish brown silt loam to a depth of 32 inches. The substratum is mottled light brownish gray and strong brown silt loam to a depth of 60 inches.

Included with this soil in mapping are a few areas of Vicksburg, Grenada, Clifty, and Belknap soils. Also included are small areas of a soil that has more clay in the subsoil, a soil that is less acid than this Collins soil, and a soil that is stratified. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate, and runoff is slow. Available water capacity is high, and the root zone is deep. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table and is subject to flooding.

This soil has good potential for cultivated crops (fig. 10). It can be cultivated in short rotations without loss of soil because the erosion hazard is slight. The soil is subject to flooding, but flooding is mostly of short duration and occurs in winter or spring when row crops are not growing. Most crops respond to application of lime and fertilizer. Drainage improves the suitability of some crops. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of cover crops and

return of crop residue to the soil increase the content of organic matter and improve the tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area; however, in some years perennials are damaged by winter flooding. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are important management needs.

This soil has good potential for trees. Most trees that are common to the area grow well on this soil. Competition from undersirable species occurs. Because the soil is wet during winter, most trees are harvested in summer and fall. Erosion generally is not a problem.

This soil has poor potential for many urban uses because of the hazard of flooding and the seasonal high water table. In most years flooding occurs in the winter and spring. Permanent structures can be protected from floods by the use of dikes and levees, but the cost is high. In some places the hazard of flooding is slight, and the cost of protection is low. In most winters the lower part of the subsoil is saturated with water for several weeks. Excess water can be removed by ditches and tile drains. This soil is suited to most uses that are restricted to dry periods. Capability class I; woodland ordination symbol 1o.

Du—Dumps. Dumps consist of areas of alluvium that have a recent overwash from nearby coal mines. The overwash is 1 to 8 feet thick and is made up of fine coal; gravel of sandstone, siltstone, shale, and slate; and soil. Coal and gravel make up 60 to 90 percent of the overwash. The soil material below the overwash is silt loam that has mottles in shades of brown and gray. It has granular structure or is structureless and stratified. Bedrock is at a depth of about 5 to 12 feet. Slopes range from 0 to 3 percent.

Most of these areas are idle. The overwash has enough toxic material, locally called copperas, to hinder plant growth. Most areas are on flood plains below old coal mines or mine spoil that is the source of the overwash. Some areas still receive toxic water.

Dumps have poor potential for most uses because of coarse fragments and fine coal, toxic overwash, and the hazard of flooding and a seasonal high water table. Not assigned to a capability subclass; no woodland ordination symbol.

ElB—Elk silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is mainly on stream terraces in the Green River Valley. It is on low narrow ridges roughly parallel to the river. This soil is also in a few areas in the southern part of Muhlenberg County on stream terraces below soils on uplands that formed in residuum derived from limestone. Most areas are 400 to 600 feet wide and 1,000 to 3,000 feet long.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 50 inches. The upper part is strong brown silty clay loam to a depth of 36 inches; the lower part is yellowish brown light silty clay loam to a depth of 50 inches. The substratum is mottled brown and grayish brown heavy silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Otwell soils. Also included is a soil that has more sand throughout the profile than the Elk soil. Included soils make up about 10 to 20 percent of the map unit.

Permeability is moderate, and runoff is medium. Available water capacity is high. The root zone is deep, and natural fertility is medium to high. This soil is strongly acid or very strongly acid unless limed. Most areas of this soil are above flood level, but a few areas are infrequently flooded. The soil has low strength.

This soil has good potential for cultivated crops. The erosion hazard is moderate in cultivated areas. This soil is suited to most cultivated crops that are grown in the area. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of mimimum tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and including grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for most grasses and legumes that are grown in the area. Most of this soil is above flood level, but in a few places perennial grasses and legumes may be damaged by floodwater. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most species that are common to the area grow well on this soil. Competition from undesirable species can be controlled by site preparation, spraying, cutting, or girdling. Erosion generally is not a problem.

This soil has fair potential for most urban uses. The main limitation is the hazard of flooding. Most of this soil is in the Green River Valley where floods occur rarely but last for several days. Permanent structures can be protected from floods by the use of dikes and levees. Capability subclass IIe; woodland ordination symbol 2o.

ElC—Elk silt loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is mainly on the sides of stream terraces in the Green River Valley. Areas of this soil are mainly 200 to 500 feet wide and 1,000 to 2,000 feet long.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 50 inches. The upper part is strong brown silty clay loam to a depth of 36 inches; the lower part is yellowish brown light silty clay loam to a depth of 50 inches. The substratum is mottled brown and grayish brown heavy silt loam to a depth of 60 inches.

Included with this soil in mapping are a few areas of Otwell soil and a few areas of a moderately well drained soil that does not have a fragipan. Also included are a few areas of a severely eroded soil that has a silty clay loam surface layer. The included soils make up about 15 to 25 percent of the map unit.

Permeability and runoff are moderate. The root zone is deep. Available water capacity is high. Organic-matter content is low or moderate, and natural fertility is medium to high. This soil is strongly acid or very strongly acid unless limed. Most areas of this soil are above flood level, but a few areas are infrequently flooded. This soil has low strength.

This soil has fair potential for cultivated crops. The erosion hazard is severe in cultivated areas. This soil is suited to most crops that are grown in the area. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. Minimum tillage, contour cultivation, stripcropping, use of cover crops, addition of organic matter, use of grassed waterways, and including grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for most grasses and legumes that are grown in the area. Most of this soil is above flood level, but in a few places perennial grasses and legumes may be damaged by floodwater. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most species that are common to the area grow well on this soil. Competition from undesirable species can be controlled by site preparation, spraying, cutting, or girdling.

This soil has fair potential for most urban uses because of the hazard of flooding and the slope. Most permanent structures can be protected from floods by the use of dikes and levees. Grading and leveling are needed for some uses because of the slope. During construction, the use of temporary plant cover helps control erosion until permanent cover can be established. Capability subclass IIIe; woodland ordination symbol 2o.

FlD—Frondorf-Lenberg complex, 12 to 20 percent slopes. This complex consists of small areas of Frondorf and Lenberg soils that are so intermingled that they could not be separated at the scale used in mapping. These soils are on hillsides mainly in the southern part of the survey area. Slopes are 200 to 600 feet long. The mapped areas range from 5 to 40 acres in size. Both of these soils are moderately deep and well drained.

The Frondorf soil makes up about 45 percent of the map unit. Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 32 inches. The upper part is brown silt loam to a depth of 20 inches; the lower part is strong brown channery silt loam to a depth of 32 inches. Sandstone bedrock is at a depth of 32 inches.

In the Frondorf soil, permeability and available water capacity are moderate. The root zone is moderately deep. Organic-matter content is low, and natural fertility is medium. The Frondorf soil is strongly acid or very strongly acid unless limed.

The Lenberg soil makes up about 35 percent of the map unit. Typically, the surface layer is silt loam about 4 inches thick and is very dark grayish brown in the upper part and brown in the lower part. The subsoil extends to a depth of 25 inches. The upper part is strong brown silty clay loam that extends to a depth of 18 inches; the lower part is strong brown silty clay that extends to a depth of 25 inches. The substratum, to a depth of 35 inches, is mottled light olive brown and light gray very gravelly silty clay. Acid, soft shale is at a depth of 35 inches.

In the Lenberg soil, permeability is moderately slow, and available water capacity is moderate. The root zone is moderately deep. Organic-matter content is low, and natural fertility is medium. The Lenberg soil is strongly acid or very strongly acid unless limed. It tends to shrink and swell and has low strength.

Included with this complex in mapping are soils that are deeper to bedrock than Frondorf and Lenberg soils, and severely eroded soils that have a surface layer of silty clay loam. Some areas of these severely eroded soils are identified on the soil map with a spot symbol. Also included are soils that are similar to the Frondorf soil but have a sandy loam subsoil or have 5 to 15 percent coarse fragments in the surface layer.

These soils have fair potential for cultivated crops. The erosion hazard is very severe. The soils are suited to most row crops and small grain crops that are grown in the area. Crops respond well to the application of lime and fertilizer. If these soils are used for cultivated crops, intensive measures are needed to control erosion and reduce runoff.

These soils have fair potential for hay and pasture. They are suited to most grasses and legumes that are grown in the area. The use of proper seeding rates and mixtures, contour farming, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

These soils have fair potential for trees, and in many areas they are used for hardwoods. Potential productivity is higher on north-facing slopes than on south-facing slopes. Because of moderately steep slopes, erosion is a hazard during harvesting and planting operations. In some places slope limits the use of equipment. The control of undesirable species is a concern in woodland management.

These soils have poor potential for most urban uses because of slope and depth to bedrock. For many urban uses considerable cutting and filling are necessary but are limited by bedrock at a depth of 20 to 40 inches. In most places, the bedrock can be excavated with earth-moving equipment. The moderately slow permeability, moderate shrink-swell potential, and low strength of the Lenberg soil are limitations for some uses. Capability subclass IVe; woodland ordination symbols: Frondorf soil, north aspect 2r, south aspect 3r; Lenberg soil, north aspect 3c, south aspect 4c.

FlE—Frondorf-Lenberg complex, 20 to 30 percent slopes. This complex consists of small areas of Frondorf and Lenberg soils that are so intermingled that they could not be separated at the scale used in mapping. These soils are on hillsides mainly in the southern part of the survey area. Slopes are 200 to 600 feet long. The mapped areas range from 5 to 50 acres in size. Both of these soils are moderately deep and are well drained.

The Frondorf soil makes up about 40 percent of the map unit. Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 32 inches. The upper part of the subsoil is brown silt loam to a depth of 20 inches; the lower part is strong brown very channery silt loam to a depth of 32 inches. Sandstone bedrock is at a depth of 32 inches.

In the Frondorf soil, permeability and available water capacity are moderate. The root zone is moderately deep. Organic-matter content is low, and natural fertility is medium. The Frondorf soil is strongly acid or very strongly acid unless limed.

The Lenberg soil makes up about 30 percent of the map unit. Typically, the surface layer is silt loam about 4 inches thick. It is very dark grayish brown in the upper part and brown in the lower part. The subsoil extends to a depth of 25 inches. The upper part is strong brown silty clay loam to a depth of 18 inches; the lower part is strong brown silty clay to a depth of 25 inches. The substratum is mottled light olive brown and light gray very gravelly silty clay to a depth of 35 inches. Acid, soft shale is at a depth of 35 inches.

In the Lenberg soil, permeability is moderately slow, and available water capacity is moderate. The root zone is moderately deep. Organic-matter content is low, and natural fertility is medium. The Lenberg soil is strongly acid or very strongly acid unless limed. It has a tendency to shrink and swell and has low strength.

Included with this complex in mapping are soils that are deeper to bedrock than Frondorf and Lenberg soils and soils that are not so deep. Also included are some areas of rock outcrop and rock escarpments that are mostly in the southern part of Muhlenberg County; some soils that are similar to the Frondorf soil but have more sand or coarse fragments throughout; and small areas of severely eroded soils that have more clay in the surface layer, or are not so deep to bedrock, or are both shallower and more clayey than the uneroded soils. Areas of Wellston and Zanesville soils on hilltops and areas of Collins and Clifty soils along the draws are also included.

These soils have poor potential for cultivated crops because of the hazard of erosion. They have fair potential for grasses and legumes and for pasture and hay. Crops respond well to the application of lime and fertilizer. Erosion control measures are needed during seedbed preparation and pasture renovation. Grazing should be controlled to maintain plant cover. Control of weeds and use of proper seeding rates and mixtures are other management needs.

These soils have fair potential for trees, and most areas are in native hardwoods. Most trees that are suitable to upland soils in the area grow well on these soils. Productivity is higher on north-facing slopes than on south-facing slopes. Steep slopes limit the use of harvesting and planting equipment. Erosion is probable along haul roads and skidtrails. The control of undesirable species is a concern in woodland management.

These soils have poor potential for most urban uses because of slope and depth to bedrock. For some uses the slope is too steep, and for other uses considerable grading and leveling are necessary but the amount of grading and cutting are limited by bedrock. Bedrock, however, can be excavated with earth-moving equipment in most places. Moderately slow permeability, moderate shrink-swell potential, and low strength of the Lenberg soil are limitations for some uses. Coarse fragments in the Frondorf soil interfere with some uses. Capability subclass VIe; woodland ordination symbols: Frondorf soil, north aspect 2r, south aspect 3r; Lenberg soil, north aspect 3c, south aspect 4c.

FlF—Frondorf-Lenberg complex, 30 to 50 percent slopes. This complex consists of small areas of Frondorf and Lenberg soils that are so intermingled that they could not be separated at the scale used in mapping. These soils are on hillsides mainly in the southern part of the survey area. Slopes are 200 to 600 feet long. The mapped areas range from 5 to 75 acres in size and most of the large areas include draws. Both of these soils are moderately deep and well drained.

The Frondorf soil makes up about 45 percent of the map unit. Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 32 inches. The upper part of the subsoil is brown silt loam to a depth of 20 inches; the lower part is strong brown channery silt loam to a depth of 32 inches. Sandstone bedrock is at a depth of 32 inches.

In the Frondorf soil, the root zone is moderately deep. Permeability and available water capacity are moderate. Organic-matter content is low, and natural fertility is medium. The Frondorf soil is strongly acid or very strongly acid unless limed.

The Lenberg soil makes up about 20 percent of the map unit. Typically, the surface layer is silt loam about 4 inches thick and is very dark grayish brown in the upper part and brown in the lower part. The subsoil extends to a depth of 25 inches. The upper part is strong brown silty clay loam to a depth of 18 inches; the lower part is strong brown silty clay to a depth of 25 inches. The substratum is mottled light olive brown and light gray very gravelly silty clay to a depth of 35 inches. Acid, soft shale is below a depth of 35 inches.

In the Lenberg soil, permeability is moderately slow, and available water capacity is moderate. The root zone is moderately deep. Organic-matter content is low, and natural fertility is medium. The Lenberg soil is acid or very

strongly acid unless limed. It tends to shrink and swell and has low strength.

Included with this complex in mapping are soils that are deeper to bedrock than the Frondorf and Lenberg soils, soils that are not so deep, and areas of soils that are severely eroded and have a silty clay loam surface layer. Some severely eroded soils are identified on the soil map with a spot symbol. Also included is a soil that is similar to the Frondorf soil but has a sandy loam subsoil, a soil that is similar to the Frondorf soil but has more coarse fragments in the surface layer, areas of Wellston and Zanesville soils on hilltops, and areas of Collins and Clifty soils along draws.

The Frondorf and Lenberg soils have poor potential for cultivated crops and for hay and pasture because of the hazard of erosion. Some areas of these soils can be used for hay and pasture if a good plant cover is maintained. Seeding on the contour, application of lime and fertilizer, use of proper seeding rates and mixtures, control of weeds, and control of grazing help to maintain a good plant cover. In some places, mowing and reseeding are difficult because of steep slopes, outcrops of rock, and rock fragments.

These soils have fair potential for trees, and most areas are in native hardwoods. Most trees that are suited to upland soils grow well on these soils. Productivity is higher on north-facing slopes than on south-facing slopes. Steep slopes limit the use of harvesting and planting equipment. Erosion is probable along haul roads and skidtrails.

These soils have poor potential for most urban uses because of slope and depth to bedrock. For most uses considerable grading and leveling are needed, but grading and cutting are limited by bedrock. In most places, however, bedrock can be excavated with earth-moving equipment. Moderately slow permeability, moderate shrink-swell potential, low strength of the Lenberg soil, and coarse fragments in the Frondorf soil and outcrops of rock are limitations for some uses. Capability subclass VIIe; woodland ordination symbols: Frondorf soil, north aspect 2r, south aspect 3r; Lenberg soil, north aspect 3c, south aspect 4c.

GrA—Grenada silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is mainly on wide ridgetops and in a few places at the base of steeper slopes. The mapped areas are 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown heavy silt loam to a depth of 24 inches, and very pale brown and strong brown silt loam to a depth of 28 inches. Below 28 inches and to a depth of 60 inches is a firm to very firm, compact, brittle fragipan. The upper part of the fragipan to a depth of 43 inches is light silty clay loam that has brown, grayish brown, and yellowish brown mottles; the lower part is mottled, dark yellowish brown and brown silt loam.

Included with this soil in mapping are a few areas of Loring, Calloway, and Collins soils and some soils in which the lower part of the solum formed in residuum derived from sandstone and shale. Included in places are Collins and Belknap soils below steeper slopes. Also included is a soil that has a weakly developed fragipan. The included soils make up 15 to 25 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is slow. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is medium acid to very strongly acid unless limed. It has low strength and a seasonal high water table perched over the fragipan.

This soil has good potential for cultivated crops. The erosion hazard is slight, and the soil can be cultivated intensively. The soil is suited to most cultivated crops that are grown in the area. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. Use of cover crops and return of crop residue to the soil increase the content of organic matter and improve the tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area, but some deep rooted crops die after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil. The use of planting, harvesting, and managing equipment is somewhat restricted during wet periods. The control of undersirable species is a concern in woodland management.

This soil has good potential for most urban uses. The nearly level soil is above the flood plain, and is a good site for buildings. Slow permeability of the fragipan and a seasonal water table perched above the fragipan are severe limitations for septic tank filter fields, but these limitations can be overcome by enlarging the absorption area or by modifying the filter field. The seasonal high water table occurs mainly in winter and early in spring and is a limitation for many uses. This soil is suited to most uses that are restricted to dry periods. The low strength of this soil can be overcome by good design and careful installation. Capability subclass IIw; woodland ordination symbol 3o.

GrB—Grenada silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is mainly on wide ridgetops and, in a few places, at the base of steeper slopes. The mapped areas are mostly 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown heavy silt loam to a depth of 24 inches and very pale brown and strong brown silt loam to a depth of 28 inches. Below 28 inches and to a depth of 60 inches is a firm to very firm, compact, brittle

fragipan. The upper part of the fragipan to a depth of 43 inches is light silty clay loam that has brown, grayish brown, and yellowish brown mottles. The lower part is mottled dark yellowish brown and brown silt loam.

Included with this soil in mapping are a few small areas of Calloway and Collins soils and some soils in the southern part of the survey area that have some sandstone fragments in the lower part of the profile. The included soils make up 20 to 30 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is medium, and the root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is medium acid to very strongly acid unless limed. It has low strength.

This soil has good potential for cultivated crops. This soil is suited to most cultivated crops that are grown in the area. The erosion hazard is moderate. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, use of cover crops, addition of organic matter, use of grassed waterways, and the use of grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for most grasses and legumes that are grown in the area, but some deep rooted crops die after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil. The use of planting, harvesting, and managing equipment is somewhat restricted during wet periods. The control of undesirable species is a concern in woodland management.

This soil has good potential for most urban uses. It is gently sloping above the flood plain and is a good site for buildings. Slow permeability in the fragipan and a seasonal water table perched above the fragipan are severe limitations for septic tank filter fields, but these limitations can be overcome by enlarging the absorption area or by modifying the filter field. The seasonal water table occurs mainly in winter and early in spring and is a limitation for many uses. This soil is suited to most uses that are restricted to dry periods. The low strength of this soil can be overcome by good design and careful installation. Capability subclass IIe; woodland ordination symbol 3o.

He—Henshaw silt loam. This deep, nearly level, somewhat poorly drained soil is on stream terraces along the Green River and its major tributaries. Most areas are slightly higher than adjacent soils and are above flood level, but a few low areas are subject to flooding. The mapped areas are 5 to 50 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. The upper part to a depth of 24 inches is yellowish brown heavy silt loam that has mottles of light gray and light brownish gray. The lower part to a depth of 48 inches is brown and strong brown silty clay loam that has mottles of light brownish gray and light gray. The substratum, to a depth of 60 inches, is mottled strong brown and light gray heavy silt loam.

Included with this soil in mapping are a few areas of McGary, Weinbach, and Belknap soils. Also included are a soil that is silty clay in the substratum and a soil that has 4 to 8 percent slopes. The included soils make up 15 to 25 percent of the map unit.

Permeability is moderately slow, and runoff is slow. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. The surface layer is strongly acid or medium acid unless limed. This soil has low strength.

This soil has good potential for cultivated crops. It can be intensively cultivated without significant loss of soil because the erosion hazard is slight. The plow layer is easy to till and can be worked within a wide range of moisture content. Most crops that are common to the area grow well on this soil; however, drainage significantly improves the suitability of some crops. The use of cover crops, application of lime and fertilizer, and return of crop residues to the soil are important management practices.

This soil has good potential for hay and pasture. Most grasses and legumes that are common to the area can be grown on this soil, but plants that require a well drained soil are poorly suited. Drainage improves the suitability of some crops. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most trees that are common to the area grow well on this soil. Undesirable species can be controlled by cutting, spraying, or girdling. Most trees are harvested in summer and fall because use of equipment is limited during wet seasons.

This soil has poor potential for most urban uses because of the hazard of flooding and the seasonal high water table. On most of this soil floods rarely occur, but last for several days. Permanent structures can be protected from floods by the use of dikes and levees. The subsoil is saturated with water for several weeks in most winters. This soil is suited to most uses that are restricted to dry periods. Capability subclass IIw; woodland ordination symbol 1w.

Ko—Karnak silt loam, overwash. This deep, nearly level, poorly drained soil is in wide valleys in McLean County and in the northern part of Muhlenberg County. The mapped areas range from 10 to 600 acres in size. This soil is subject to flooding.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches. The upper part is mottled dark grayish brown and gray silty clay to a depth of 21 inches; the lower part is mottled gray, yellowish brown, and strong brown clay to a depth of 60 inches.

Included with this soil in mapping are a few areas of soils that have 15 to 20 inches of silt loam overwash, a few areas of soils that are very dark gray below the overwash, and areas of McGary and Melvin soils. The included soils make up about 15 to 25 percent of the map unit.

Permeability and runoff are slow. Available water capacity is high. The root zone is deep, except when it is limited by the seasonal high water table of this soil. Organic-matter content is low, and natural fertility is high. The plow layer is strongly acid or medium acid unless limed. This soil has a seasonal high water table and is subject to flooding. The clayey subsoil has a tendency to shrink and swell and has low strength.

This soil has good potential for cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Flooding mostly occurs in winter or spring when row crops are not growing. Most row crops that are common in the area can be grown on this soil if it is adequately drained. Tilth is good, and this soil can be worked within a wide range of moisture content. Use of cover crops, application of lime and fertilizer, and return of crop residue to the soil are important management practices.

This soil has fair potential for hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage lowers the water table and improves the suitability of most plants. In some places grasses and legumes are damaged by flooding. The use of suitable plants and proper seeding rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most species that are suited to wet soils grow well on this soil. Undesirable species are controlled by cutting. Most trees are harvested in summer and fall, because use of equipment is limited during wet periods. Erosion generally is not a problem.

This soil has poor potential for urban uses because of the hazard of flooding and the seasonal high water table. Flooding generally occurs in winter or early in spring. This soil is also saturated with water for several weeks in most winters. Urban improvements can be protected from flooding by the use of dikes and levees, and excess water can be removed by the use of ditches and tile drains. This soil is limited by high shrink-swell potential and low strength of the soil. It is difficult to grade, excavate, or compact because of its plastic and sticky consistence. Capability subclass IIIw; woodland ordination symbol 1w.

Ks—Karnak silty clay. This deep, nearly level, poorly drained soil is in wide, level areas in the central and northwestern parts of McLean County and in the northern part of Muhlenberg County. Most areas are occasionally flooded by the Green River and the Pond River. The mapped areas range from 20 to 800 acres in size.

Typically, the surface layer is dark grayish brown silty clay about 8 inches thick. The subsoil extends to a depth of 60 inches. The upper part is mottled dark grayish brown and gray silty clay to a depth of 11 inches; the lower part is gray clay that has mottles of yellowish brown and strong brown to a depth of 60 inches.

Included with this soil in mapping are some areas of Karnak soils that have a surface layer of silty clay loam or clay and some soils that are darker in the surface layer than the Karnak soil. Also included are small areas of Melvin and McGary soil. The included soils make up about 15 to 20 percent of the map unit.

Permeability is very slow, and runoff is slow. Available water capacity is high. The root zone is deep, except when it is limited by the seasonal high water table. Organic-matter content is low, and natural fertility is high. The plow layer is strongly acid or medium acid unless limed. This soil has a seasonal high water table and is subject to flooding. It has high shrink-swell potential and low strength.

This soil has good potential for cultivated crops (fig. 11). It is not subject to erosion and can be cultivated intensively without loss of soil. Flooding occurs mostly in winter or spring when row crops are not growing. Most row crops that are in the area can be grown on this soil if it is adequately drained. Crops respond to application of fertilizer, but some soils do not need lime. This soil has poor workability, because the plow layer is sticky and plastic when wet and hard and cloddy when dry. It is easiest to work when moisture content is almost ideal. The use of cover crops and return of crop residue to the soil are important management practices.

This soil has fair potential for hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage lowers the water table and improves the suitability of plants. In some places grasses and legumes are damaged by flooding. The use of suitable plants and proper seeding rates, application of fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most species that are suited to wet soils grow well on this soil. Undesirable species are controlled by cutting. Most trees are harvested in summer and fall, because use of equipment is limited during wet periods. Erosion generally is not a problem.

This soil has poor potential for urban uses because of the hazard of flooding and the seasonal high water table. Flooding generally occurs in winter or early in spring. This soil is saturated with water for several weeks in most winters. Urban improvements can be protected from flooding by the use of dikes and levees, and excess water can be removed by the use of ditches and tile drains. This soil is limited by high shrink-swell potential and low strength. It is difficult to grade, excavate, or compact, because of its plastic and sticky consistence. Capability subclass IIIw; woodland ordination symbol 1w.

Ld—Lindside silt loam. This deep, nearly level, moderately well drained soil is mainly near the Green River in both counties and near outcrops of limestone in the southwestern part of Muhlenberg County. It formed in

alluvium on flood plains. Most mapped areas are about 10 to 40 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 40 inches. The upper part is brown heavy silt loam to a depth of 18 inches; the lower part to a depth of 40 inches is brown silt loam that has mottles of grayish brown and yellowish brown. The substratum, to a depth of 60 inches, is grayish brown silt loam and has brown mottles.

Included with this soil in mapping are areas of Nolin and Newark soils. Also included are a soil that has more sand in the subsoil, a soil that is mildly alkaline in the subsoil, a soil that is more acid in the subsoil than the Lindside soil, and a soil that has a dark brown surface layer. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate, and runoff is slow. Available water capacity is high. The root zone is deep. Organic-matter content is low to moderate, and natural fertility is medium to high. This soil is medium acid or slightly acid. It has a seasonal high water table and is subject to flooding.

This soil has good potential for cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Flooding occurs mostly in winter or spring when row crops are not growing. Crops respond to the application of fertilizer. Drainage improves the suitability of some crops. The plow layer is easy to till and can be worked within a wide range of moisture content. Use of cover crops and return of crop residue to the soil increase the content of organic matter and improve tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The common management needs of hay and pasture apply to grasses and legumes on this soil. The use of suitable plants and proper seeding rate, application of fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most species that are suited to lowlands in this area grow well on this soil. Competition from undesirable trees, shrubs, and vines are controlled by site preparation, spraying, cutting, or girdling. Most trees are harvested in summer and fall, because the soil is wet in winter. Erosion generally is not a problem.

This soil has poor potential for most urban uses because of the hazard of flooding and the seasonal high water table. In most years, flooding occurs in winter and spring. Permanent installations can be protected from flooding by the use of dikes and levees. In most winters, the lower part of the subsoil is saturated with water for several weeks. Excess water can be removed by the use of ditches and tile drains. This soil is suited to most urban uses that are restricted to dry periods. Capability class I; woodland ordination symbol 1w.

LoB—Loring silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is mainly on hilltops in McLean County and in the northern part of Muhlenberg County. Most mapped areas are narrow and winding. They range from about 200 to 500 feet wide and are about 5 to 25 acres in size. Slopes are mostly convex.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 50 inches. The upper part is strong brown light silty clay loam and yellowish brown silt loam to a depth of 33 inches; the lower part, to a depth of 50 inches, is a brown light silty clay loam and brown silt loam, very firm, compact, brittle fragipan that has light gray and strong brown mottles. The substratum, to a depth of 64 inches, is yellowish brown silt loam that has pale brown and light gray mottles.

Included with this soil in mapping are small areas of Memphis and Zanesville soils. Also included are a Loring soil that is severely eroded and has a surface layer of silty clay loam and has a fragipan at a depth of about 20 inches and a soil that has 6 to 10 percent slopes in some areas. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table and is low in strength.

This soil has good potential for cultivated crops. It is suited to most cultivated crops that are grown in the area. The hazard of erosion is moderate when this soil is cultivated. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep rooted crops die out after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most trees that are suited to uplands in the area grow well on this soil, and a few small areas remain in native hardwoods. Young trees grow well and survive if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil has good potential for most urban uses. It is on uplands and is a good site for buildings. Slow permeability in the fragipan is a severe limitation for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area or by modifying the filter field. The low strength of this soil can be overcome by good design and careful installation. Capability subclass IIe; woodland ordination symbol 3o.

LoC—Loring silt loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is on hillsides and hilltops in McLean County and in the northern part of Muhlenberg

County. Some large mapped areas have hillside draws. The mapped areas range from about 5 to 50 acres in size. Slopes are mostly 200 to 600 feet long.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 50 inches. The upper part is strong brown light silty clay loam and yellowish brown silt loam to a depth of 33 inches; the lower part, to a depth of 50 inches, is a brown light silty clay loam and brown silt loam, very firm, compact, brittle fragipan that has light gray and strong brown mottles. The substratum, to a depth of 64 inches, is yellowish brown silt loam that has pale brown and light gray mottles.

Included with this soil in mapping are small areas of Memphis, Wellston, and Zanesville soils. Also included are a Loring soil that is severely eroded and has a fragipan at a depth of about 20 inches, a soil that has 2 to 6 percent slopes, and a soil that has 12 to 18 percent slopes. Included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table perched over the fragipan and is low in strength.

This soil has fair potential for cultivated crops. It is suited to most cultivated crops that are grown in the area. The erosion hazard is severe when this soil is cultivated. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, and grassed waterways and the addition of organic matter and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep rooted crops die out after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most trees that are suited to the uplands grow well on this soil, and a few small areas remain in native hardwoods. Young trees survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil has fair potential for most urban uses. Good building sites are on hilltops. Slow permeability in the fragipan is a severe limitation for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area or by modifying the filter field. Grading and leveling are needed for some uses because of slope. The use of temporary plant cover during construction helps control erosion until permanent cover can be established. Good design and careful installation overcome the low strength of this soil. Capability subclass IIIe; woodland ordination symbol 3o.

LoC3—Loring silt loam, 6 to 12 percent slopes, severely eroded. This deep, sloping, well drained soil is on hillsides in McLean County and in the northern part of Muhlenberg County. In some areas, rills and gullies that are 2 to 3 feet deep make up less than 20 percent of the area. Slopes are 200 to 800 feet long, and many areas have hillside drains. The original surface layer of this soil and, in places, some of the subsoil have been lost by erosion from more than 30 percent of the survey area. The fragipan is at a depth of about 18 inches.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 35 inches. The upper part is yellowish brown silt loam to a depth of 18 inches; the lower part is a very firm, compact, brittle fragipan to a depth of 35 inches and is brown mottled light silty clay loam in the upper 10 inches and brown mottled silt loam in the lower 7 inches. The substratum is mottled, yellowish brown silt loam to a depth of 49 inches.

Included with this soil in mapping are small areas of Memphis, Wellston, Zanesville, and Grenada soils. Also included are some uneroded soils, mostly near the top or bottom of slopes. Mapped areas that include draws have areas of Collins, Belknap, Waverly, or Calloway soils. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow in the fragipan. Runoff is medium. The root zone is shallow to the fragipan. Available water capacity is moderate. Content of organic matter is low, and natural fertility is medium. The soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table perched over the fragipan and is low in strength.

This soil has poor potential for cultivated crops. The erosion hazard is very severe in cultivated areas. The use of minimum tillage, contour cultivation, stripcropping, cover crops, and grassed waterways and the addition of organic matter and including grasses and legumes in the rotation help to reduce runoff and erosion. Crops respond to the application of lime and fertilizer.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep rooted crops die out within a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most trees that are common to the area grow well on this soil. Many areas are producing second growth shrubs, bushes, and trees. Slopes generally are not a concern. The control of undesirable species is a concern of woodland management.

This soil has fair potential for most urban uses. Slow permeability in the fragipan is a severe limitation for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area or by modifying the filter

field. Grading and leveling are needed for some uses because of slope. The use of temporary plant cover during construction helps control erosion until permanent cover can be established. Good design and careful installation can overcome the low strength of this soil. Capability subclass IVe; woodland ordination symbol 3o.

LoD—Loring silt loam, 12 to 20 percent slopes. This deep, moderately steep, well drained soil is on hillsides mainly in the northern part of McLean County. Slopes are mostly 200 to 600 feet long. The mapped areas are 10 to 50 acres in size. Most areas are crossed by draws.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 50 inches. The upper part is strong brown silty clay loam and yellowish brown silt loam to a depth of 33 inches; the lower part, to a depth of 50 inches, is a brown light silty clay loam and brown silt loam, very firm, compact, brittle fragipan that has light gray and strong brown mottles. The substratum, to a depth of 64 inches, is yellowish brown silt loam that has pale brown and light gray mottles.

Included with this soil in mapping are small areas of Memphis, Wellston, and Zanesville soils. Also included are areas of soils that have draws, narrow bands of Belknap or Collins soils, narrow bands of Grenada soils near the base of some slopes, and areas of a soil that has a silty clay loam surface layer. Included soils make up about 25 to 30 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow in the fragipan. Runoff is rapid. The root zone is moderately deep to the fragipan. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table perched over the fragipan and is low in strength.

This soil has poor potential for cultivated crops because the erosion hazard is very severe. The use of minimum tillage, contour cultivation, stripcropping, cover crops, and grassed waterways and the addition of organic matter and including grasses and legumes in the rotation help reduce runoff and control erosion. Crops respond to the application of lime and fertilizer.

This soil has poor potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep rooted crops die out after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees, and many areas are in hardwoods. Most trees that are suited to uplands in the area grow well on this soil. Undesirable species can be controlled by site preparation, spraying, cutting, or girdling. The moderately steep slopes cause an erosion hazard and limit equipment use.

This soil has poor potential for most urban uses because of slope. For many urban uses considerable grading and leveling are needed to reduce slope, but for some uses grading and leveling may not be practical. Erosion is probable during construction, and the use of temporary plant cover helps control erosion until permanent cover can be established. The low strength of this soil can be overcome by good design and careful installation. Capability subclass IVe; woodland ordination symbol 3r.

LoD3—Loring silt loam, 12 to 20 percent slopes, severely eroded. This deep, moderately steep, well drained soil is on hillsides mainly in the northern part of McLean County. Slopes are 200 to 600 feet long. Many areas are crossed by draws. The original surface layer has been lost by erosion from 50 percent of the area, and small rills or gullies cover 10 to 20 percent of the area.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 35 inches. The upper part, to a depth of 18 inches, is yellowish brown silt loam; the lower part, to a depth of 35 inches, is a fragipan that is brown mottled light silty clay loam in the upper 10 inches and brown mottled silt loam in the lower 7 inches. The substratum is yellowish brown mottled silt loam to a depth of 49 inches.

Included with this soil in mapping are small areas of Memphis, Wellston, and Zanesville soils. Also included are areas of soils that have draws, narrow bands of Belknap or Collins soils, narrow bands of Grenada soils near the base of some slopes, and areas of a soil that has a silty clay loam surface layer. The included soils make up about 25 to 30 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow in the fragipan. Runoff is rapid. The root zone is shallow to the fragipan. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table perched over the fragipan and is low in strength.

This soil has poor potential for cultivated crops. It is generally unsuited to cultivation because of the severe erosion hazard.

This soil has fair potential for hay and pasture. If adequate amounts of lime and fertilizer are applied, it is suited to most grasses and legumes that are grown in the area. Overgrazing of pasture and frequent renovation generally result in erosion. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil. Many areas are producing second growth shrubs, bushes, and trees. Potential productivity is lower on this soil than on uneroded soils. The slopes generally limit the use of equipment and cause a hazard of erosion. The control of undesirable species is a concern in woodland management.

This soil has poor potential for most urban uses because of slope. For many urban uses considerable grading and leveling are needed to reduce the slope, but for some uses grading and leveling may not be practical. Erosion is probable during construction, and the use of

temporary plant cover helps control erosion until permanent cover can be established. The low strength of the soil can be overcome by good design and careful installation. Capability subclass VIe; woodland ordination symbol 4r.

MaE—Markland soils, 12 to 35 percent slopes. This map unit consists of Markland silt loam, Markland silty clay loam and Markland silty clay that have not been separated in mapping. Markland silty clay is mostly severely eroded. These deep, moderately steep and steep, well drained to moderately well drained soils are on short slopes on the sides of stream terraces. They are bounded on one side by nearly level soils on stream terraces and on the other side by nearly level soils on flood plains. Many areas are crossed by small draws. Most areas are subject to flooding.

Typically, the surface layer of Markland silt loam is dark grayish brown and grayish brown about 3 inches thick. The subsoil extends to a depth of 42 inches. The upper part, to a depth of 30 inches, is yellowish brown silty clay that has mottles of gray in the lower 15 inches; the lower part, to a depth of 42 inches, is mottled dark grayish brown, brown, and gray silty clay. The substratum, to a depth of 60 inches, is grayish brown clay that has strong brown mottles.

Typically, Markland silty clay loam and Markland silty clay each have a profile similar to Markland silt loam except for texture of the surface layer.

Included with these soils in mapping are a few areas of McGary soil, a soil that has less clay in the subsoil, and a few areas of earth escarpments. Also included are a few areas of Belknap and Newark soils that are crossed by draws. The included soils make up about 15 to 25 percent of the map unit.

Permeability is slow and runoff is rapid. The root zone is deep. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is medium acid to strongly acid in the surface layer unless limed. The clayey subsoil has low strength and a high shrink-swell potential.

These soils have poor potential for cultivated crops. They are generally unsuited to cultivation because of the severe erosion hazard. They have fair potential for hay and pasture. Most grasses and legumes that are common to the area grow well on this soil; perennials, however, are damaged in some years by floodwaters. Grasses and legumes respond to the application of lime and fertilizer, except in a few severely eroded areas where lime is not needed. Runoff is rapid because of steep slopes and slow permeability in the subsoil. Overgrazing of pasture and frequent renovation generally result in erosion. Maintaining a sod that prevents excessive erosion is the main management need; the use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are also important management needs.

These soils have fair potential for trees, and most areas are in hardwoods. Most trees that are native to the area grow well on this soil. Desirable species grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling. The use of planting, managing, and harvesting equipment is limited by steep slopes and by flooding in winter and spring. Erosion occurs along haul roads and skidtrails.

These soils have poor potential for urban uses mainly because of slope and the hazard of flooding. Flooding in most winters severely limits the uses of this soil for such permanent structures as buildings. Dikes and levees to protect from flooding are difficult to build because of the position of this soil. For many urban uses considerable grading and leveling are needed to reduce the slope, but for some uses grading and leveling are not practical. The clayey subsoil is difficult to grade, excavate, or compact. High shrink-swell potential and low strength of the subsoil are limitations that can be overcome by good design and careful installation. Capability subclass VIe; woodland ordination symbol 2c.

Mc—McGary silt loam. This deep, nearly level, somewhat poorly drained soil is on wide, flat stream terraces in the Green River Valley. Most areas are a few feet higher than the adjacent soils. Most of this soil is above flood level, but a few areas are subject to flooding.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 45 inches. The upper part, to a depth of 24 inches, is light brownish gray silty clay that has yellowish brown mottles; the lower part, to a depth of 45 inches, is mottled light olive brown, grayish brown, and yellowish brown silty clay. The substratum is mottled yellowish brown and grayish brown silty clay to a depth of 66 inches.

Included with this soil in mapping are small areas of Markland and Henshaw soils and a few areas of McGary silty clay loam. Also included are a soil that has a clay subsoil and a soil that has more slopes than the McGary soil. The included soils make up about 15 to 20 percent of the map unit.

Permeability and runoff are slow. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is medium acid or strongly acid in the surface layer unless limed. It has a seasonal high water table, a high shrink-swell potential, and low strength. It seldom floods.

This soil has fair potential for cultivated crops. It can be intensively cultivated without significant loss of soil because the hazard of erosion is slight. The plow layer is easy to till and can be worked within a wide range of moisture content. Most crops that are in the area, except those that require well drained soil, can be grown on this soil. The use of cover crops, application of lime and fertilizer, return of crop residue to the soil, and removal of excess surface water (fig. 12) are important management practices.

This soil has fair potential for hay and pasture. Most grasses and legumes that are common to the area can be grown on this soil, but plants that require a well drained soil are poorly suited. Surface drainage improves the suitability of some plants. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Seedlings have low survival. The use of equipment for planting, managing, and harvesting is restricted during wet periods. In most places, erosion is not a problem.

This soil has poor potential for urban uses, mainly because of the seasonal high water table, hazard of flooding, and clayey texture of the subsoil. The subsoil is saturated with water for several weeks during most winters, and slow permeability in the subsoil reduces the effectiveness of tile drains. Slow permeability and the seasonal high water table are severe limitations for septic tank filter fields. Most of this soil is in positions where such permanent structures as buildings can be protected from floods by dikes and levees. This soil is difficult to grade, excavate, or compact. The high shrink-swell potential and low strength are limitations when this soil is used as foundation material for buildings or roads, but these limitations can be overcome by good design and careful installation. Capability subclass IIIw; woodland ordination symbol 2w.

Me—Melvin silt loam. This deep, nearly level, poorly drained soil is in wide, flat areas that are flooded by the Green River and in narrow valleys below outcrops of limestone. The mapped areas are 5 to 100 acres in size.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of about 36 inches. It is gray heavy silt loam that has yellowish brown and light olive brown mottles. The substratum, to a depth of 60 inches, is gray light silty clay loam that has yellowish brown and light olive brown mottles.

Included with this soil in mapping are small areas of Newark and Waverly soils and a soil that is very strongly acid in the subsoil and surface layer. Also included is a soil, mainly in McLean County, that is silty clay below a depth of 40 inches. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate and runoff is slow. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. The surface layer is medium acid to mildly alkaline. The soil has a seasonal high water table and is subject to flooding.

This soil has fair potential for cultivated crops. It can be cultivated intensively without loss of soil because the hazard of erosion is slight. Most flooding occurs in winter or spring when crops are not growing. Most row crops that are common to the area can be grown on this soil if it is adequately drained. Crops respond to the application of fertilizer, but most of the commonly grown crops do not respond to lime. The use of cover crops and the return of crop residue to the soil are important management practices.

This soil has good potential for hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage lowers the water table and improves the suitability of most plants. In some places grasses and legumes are damaged by flooding. The use of suitable plants, use of proper seeding rates, application of fertilizer, control of weeds, and control of grazing are main management needs.

This soil has good potential for trees, and some areas are in native hardwoods. Most species that are suited to wet soils in the area grow well on this soil. Undesirable species of trees, vines, and shrubs can be controlled by site preparation, cutting, spraying, or girdling. Seedlings have low survival. Most tree crops are harvested in summer or fall, because the use of equipment is limited during wet periods. Erosion generally is not a problem.

This soil has poor potential for urban uses because of the hazard of flooding and the seasonal high water table. Areas of this soil are flooded during most winters and are saturated with water for several weeks; in most places, however, urban improvements can be protected by the use of dikes and levees. Excess water can be removed by drainage, but for some uses drainage may not be practical. This soil is suited to most uses that are restricted to dry periods. Capability subclass IIIw; woodland ordination symbol 1w.

MmB—Memphis silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loess on ridgetops. Slopes are slightly convex. The mapped areas are narrow and winding and are 200 to 500 feet wide and 5 to 20 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil extends to a depth of 36 inches and is brown and strong brown silty clay loam. The substratum, to a depth of 60 inches, is strong brown silt loam.

Included with this soil in mapping are a few areas of Wellston, Loring, and Grenada soils. Also included are some areas of severely eroded Memphis soil that is silty clay loam in the surface layer, and a Memphis soil that has 6 to 10 percent slopes. The included soils make up about 10 to 15 percent of the map unit.

Permeability is moderate, and runoff is medium. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is medium acid to very strongly acid unless limed. It has low strength.

This soil has good potential for cultivated crops. It is suited to most crops that are commonly grown in the area. The erosion hazard is moderate when this soil is cultivated. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, the addition of organic-matter,

and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees, and a few areas are in hardwoods. Most trees that are native to the area grow well on this soil. Tree seeds and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling.

This soil has good potential for urban uses. It can be a good site for buildings because it is on ridgetops. It has low strength when used as foundation material for buildings or roads, but this limitation can be overcome by good design and careful installation. Erosion can occur during construction unless precautionary measures are taken. Capability subclass IIe; woodland ordination symbol 2o.

MmC—Memphis silt loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is mainly on side slopes in the northern part of McLean County, and most of the large areas are on hillsides on both sides of a draw. Slopes are 400 to 800 feet long. Most areas are 5 to 40 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil extends to a depth of 36 inches and is brown and strong brown silty clay loam. The substratum, to a depth of 60 inches, is strong brown silt loam.

Included with this soil in mapping are a few areas of Loring, Grenada, and Wellston soils; areas of Memphis soil that are crossed by draws and include long, narrow areas of Collins or Belknap soils; and small areas of severely eroded soils. Some eroded soils are identified on the soil map by a spot symbol. Also included are small areas of soils that have 4 to 6 percent slopes or 12 to 15 percent slopes. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate, and runoff is medium. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil has low strength. It is medium acid to very strongly acid unless limed.

This soil has fair potential for cultivated crops. It is suited to most crops that are grown in the area, but the erosion hazard is severe when the soil is cultivated. The crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, use of cover crops, addition of organic matter, use of grassed waterways, and including grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees, and a few areas are in hardwoods. Most trees that are native to the area grow well on this soil. Tree seeds and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling.

This soil has good potential for most urban uses. Because of slope, grading and leveling are needed for some urban uses. Erosion may occur during construction unless precautionary measures are taken. Temporary plant cover helps control erosion until permanent cover can be established. This soil has low strength when used as foundation material for buildings or roads, but this limitation can be overcome by good design and careful installation. Capability subclass IIIe; woodland ordination symbol 2o.

Ne—Newark silt loam. This deep, nearly level, somewhat poorly drained soil formed in alluvium in the Green River Valley and in the southwestern part of Muhlenberg County. It is in wide, flat areas that are flooded by the Green River and in narrow valleys below outcrops of limestone.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part, to a depth of 18 inches, is brown silt loam that has light brownish gray mottles; the lower part, to a depth of 40 inches, is light gray silt loam that has brown and yellowish brown mottles. The substratum, to a depth of 60 inches, is light gray heavy silt loam that has dark brown and yellowish brown mottles.

Included with this soil in mapping are small areas of Lindside and Melvin soils. Also included are a soil that is strongly acid in some horizons and a soil that is silty clay loam in the surface layer and subsoil. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate, and runoff is slow. Available water capacity is high. The root zone is deep. Organic-matter content is low to moderate, and natural fertility is medium to high. The soil is medium acid to neutral. It has a seasonal high water table and is subject to flooding.

This soil has good potential for cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Most flooding occurs in winter or spring when row crops are not growing. Crops respond to the application of fertilizer. Drainage improves the suitability of most crops. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of cover crops and return of crop residue to the soil increase the content of organic matter and improve tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The common management needs of hay and pasture apply to grasses and legumes on this soil. The use of suitable plants and proper seeding rates, application of fertilizer, control of weeds, and control of grazing are the main management needs. In places, floods may damage grasses and legumes in winter.

This soil has good potential for trees. Most species that are suited to lowlands in the area grow well on this soil. Competition from undesirable trees, shrubs, and vines can be controlled by site preparation, spraying, cutting, or girdling. Most trees are harvested in summer and fall, because the soil is wet in winter. Erosion generally is not a problem.

This soil has poor potential for most urban uses because of the hazard of flooding and the seasonal high water table. In most years, flooding occurs during winter and spring. Permanent installations can be protected from flooding by dikes and levees. In most winters the subsoil is saturated with water for several weeks. Excess water can be removed by ditches and tile drains. This soil is suited to most urban uses that are restricted to dry periods. Capability subclass IIw; woodland ordination symbol 1w.

Nh—Nolin silt loam. This deep, well drained, nearly level soil formed in alluvium along the larger streams of the survey area. In most places it is adjacent to streams. The mapped areas range from 5 to 50 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil extends to a depth of 45 inches. The upper part is brown heavy silt loam to a depth of 30 inches; the lower part is brown heavy silt loam that has light yellowish brown and dark yellowish brown mottles. The substratum, to a depth of 65 inches, is yellowish brown silt loam that has pale brown and light brownish gray mottles.

Included with this soil in mapping are a few areas of soils that have a dark brown surface layer, a few small areas along the banks of streams that are very steep, soils that are loam or fine sandy loam throughout the profile, and a soil that is strongly acid in some parts of the profile. A few areas of Lindside and Newark soils also are included. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate, and runoff is slow. Available water capacity is high. The root zone is deep. Organic-matter content is low to moderate, and natural fertility is medium to high. The soil is medium acid or slightly acid. It is subject to flooding.

This soil has good potential for cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Most flooding occurs in winter or spring when row crops are not growing. Crops respond to the application of fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of cover crops and return of crop residue to the soil increase the content of organic matter and improve tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. In some years perennials may be damaged by winter floods. The use of proper seeding rates and mixtures, application of fertilizer, control of weeds, and control of grazing are the main mangement needs.

This soil has good potential for trees and most native trees grow well. Tree seeds and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling. Erosion generally is not a problem.

This soil has poor potential for most urban uses because of the hazard of flooding. Most floods occur during winter and spring. In places, urban structures can be protected from flooding by the use of dikes and levees. This soil is suited to most urban uses that are restricted to summer and fall. Capability class I; woodland ordination symbol 1o.

Nm—Nolin-Melvin complex. This complex consists of small areas of Nolin and Melvin soils that are so intermingled that they could not be separated at the scale used in mapping. These soils are along sloughs that drain into the Green River and on the bank of the river. The soils on the sides of the sloughs have moderately steep and steep slopes, and the soils in the bottom of the sloughs have nearly level slopes. The soils on the bank of the river are mostly steep. Nolin soils are on the sides of the sloughs and on the bank of the river, and Melvin soils are in the bottom of the sloughs. Nolin soils have slopes of 0 to 25 percent, and Melvin soils have slopes of 0 to 2 percent.

The Nolin soil makes up about 37 percent of the map unit. Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil extends to a depth of 45 inches. The upper part is brown silt loam to a depth of 30 inches, and the lower part is brown silt loam that has light yellowish brown and dark yellowish brown mottles. The substratum, to a depth of 65 inches, is yellowish brown silt loam that has pale brown and light brownish gray mottles.

In the Nolin soil, permeability is moderate and runoff is slow. Available water capacity is high. The root zone is deep. Organic-matter content is low to moderate, and natural fertility is medium to high. The Nolin soil is medium acid or slightly acid. It is subject to flooding.

The Melvin soil makes up about 20 percent of the map unit. Typcially, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of about 36 inches. It is gray silt loam that has yellowish brown and light olive brown mottles. The substratum, to a depth of 60 inches, is gray silty clay loam that has yellowish brown and light olive brown mottles.

In the Melvin soil, permeability is moderate and runoff is slow. Available water capacity is high. The root zone is deep. Organic-matter content is low to moderate, and natural fertility is medium to high. The Melvin soil is medium acid or slightly acid. It is subject to flooding, and it has a seasonal high water table.

Included with this complex in mapping are Elk and Otwell soils mainly on the sides of sloughs, Newark soil in the bottom of the sloughs, and Lindside soil in the sloughs and on the bank of the river. Also included on the bank of the river is a soil that is moderately well drained and is stratified with thin layers of loam and fine sandy loam.

The soils of this complex have poor potential for cultivated crops and hay or pasture because of the hazard of flooding, and the steep slopes.

These soils have fair potential for trees. The trees help to reduce streambank cutting on the river bank and reduce the current during floods. Most areas of this map unit are in woods. Generally, trees grow better along the sloughs than on the river bank. The use of equipment is limited by slope, wetness, and the hazard of flooding. Erosion is a problem on the Nolin soil. Undesirable species on both soils can be controlled by site preparation, cutting, spraying, or girdling.

These soils have poor potential for most urban uses because of the hazard of flooding and steep slopes. The Melvin soil has a seasonal high water table in most of the map unit. A few places near the river have good potential for such recreational uses as summer campsites, boat docks, and fishing sites. Dikes and levees that protect from flooding are difficult to build in most of the map unit. Capability subclass VIIe; woodland ordination symbols: Nolin soil, 2r; Melvin soil, 1w.

OtA—Otwell silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is mostly on low, long ridges that parallel the Green River. Many areas are about 300 to 500 feet wide and 2,000 to 6,000 feet long.

Typically, the surface layer is dark yellowish brown silt loam about 10 inches thick. The subsoil extends to a depth of 45 inches. The upper part is yellowish brown heavy silt loam to a depth of 27 inches; the lower part, to a depth of 45 inches, is a brown, light silty clay loam, firm, brittle, compact fragipan that has light brownish gray mottles. The substratum is dark yellowish brown silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Elk, Newark, and Weinbach soils. Also included is a soil that has a weakly developed fragipan. The included soils make up about 20 to 25 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is slow. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low to moderate, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. Most areas of this soil are above flood level, but a few areas are infrequently flooded. The soil has low strength and a seasonal high water table.

This soil has good potential for cultivated crops. The erosion hazard is slight, and the soil can be cultivated intensively without significant loss of soil. This soil is suited to most cultivated crops that are grown in the area. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of cover crops and return of crop residue to the soil increase the content of organic matter and improve tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area, but some deep rooted crops die after a few years. In places perennials are damaged by floods. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil.

This soil has poor potential for most urban uses because of the hazard of flooding. Floods rarely occur, but last for several days. Permanent urban structures can be protected from flooding by the use of dikes and levees. The slow permeability in the fragipan is a severe limitation for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area or by modifying the filter field. Capability subclass IIw; woodland ordination symbol 3o.

OtB—Otwell silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is mainly on long, narrow, convex ridges that parallel the Green River. Ridges are about 300 to 600 feet wide and 1,000 to 2,000 feet long. Areas in southeastern Muhlenberg County are mostly near the base of hills that have outcrops of limestone in the drainage area.

Typically, the surface layer is dark yellowish brown silt loam about 10 inches thick. The subsoil extends to a depth of 45 inches. The upper part is yellowish brown heavy silt loam to a depth of 27 inches; the lower part, to a depth of 45 inches, is a brown, light silty clay loam, firm, brittle, compact fragipan that has light brownish gray mottles. The substratum is dark yellowish brown silt loam to a depth of 60 inches.

Included with this soil in mapping are a few small areas of Elk, Newark, and Weinbach soils and a few areas of a soil in Muhlenberg County that has a thick, dark surface layer. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low to moderate, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. Most areas of this soil are above flood level, but a few areas are infrequently flooded. This soil has a seasonal high water table and low strength.

This soil has good potential for cultivated crops. It is suited to most cultivated crops that are grown in the area. The erosion hazard is moderate. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, and the addition of organic matter, and including grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area, but some deep rooted crops die after a few years. In places perennials are damaged by floods. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil.

This soil has poor potential for most urban uses because of the hazard of flooding. Floods rarely occur but last for several days. Permanent urban structures can be protected from flooding by the use of dikes and levees. The slow permeability in the fragipan is a severe limitation for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area or by modifying the filter field. Capability subclass IIe; woodland ordination symbol 3o.

Pt—Pits. This map unit consists of areas that have been mined for gravel, excavated for borrow material, or quarried for limestone.

In areas that have been mined for gravel, the original gravel deposits were 4 to 8 feet thick and consisted of 80 to 95 percent pebbles that ranged from 1/2 inch to 1 1/2 inches in diameter. The soil material underlying the gravelly deposits is loam, silt loam, or silty clay loam and is more than 10 feet thick. Pits that remain after gravel is mined are 4 to 8 feet deep and range from 2 to 20 acres in size. In places, 1 to 3 feet of gravel remains in the bottom of the pits. Most gravel pits are abandoned, and weeds or trees grow where enough of the underlying soil material has been exposed to support vegetation. Gravel pits are generally adjacent to and are 5 to 10 feet higher than alluvial soils on flood plains. They are mostly in McLean County and the northern part of Muhlenberg County.

Borrow areas consist of areas from which the soil material above the bedrock has been removed. In most places the bedrock is exposed, but in a few places 1 to 10 inches of soil material remains. The bedrock is mostly sandstone, but in a few places it is limestone or shale. Most borrow areas are idle. A sparse cover of vegetation that consists of grass and woody plants is in some places. Borrow areas are on uplands and range from 5 to 20 acres in size. Slopes are generally 2 to 6 percent but range from 0 to 10 percent. The soil material has little water storage capacity, and almost all of the rainfall runs off.

Quarries consist of areas where bedrock has been mined. The soil and several feet of bedrock have been removed, and a pit, 10 to 50 feet deep, remains. At the bottom of the quarry is sandstone or limestone bedrock. Included in mapping are adjacent loading and access areas where the soil material has been removed or covered with broken pieces of bedrock. One large quarry is operating in the southern part of Muhlenberg County. Some small quarries, most of which have been abandoned, are also in the survey area. Not assigned to a capability subclass; no woodland ordination symbol.

SaA—Sadler silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is on broad ridgetops, saddles, or toe slope terraces throughout the central and southern parts of Muhlenberg County. Areas vary from 5 to 60 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 45 inches. It is yellowish brown silt loam to a depth of 22 inches; pale brown, brown, and strong brown silt loam to a depth of 25 inches; below 25 inches and to a depth of 45 inches is a very firm, brittle and compact fragipan of mottled strong brown, brown, and light brownish gray silt loam. The substratum, to a depth of 60 inches, is mottled strong brown and light brownish gray silty clay loam. Sandstone bedrock is at a depth of 60 inches.

Included with this soil in mapping are some small areas of Zanesville, Grenada, Belknap, and Calloway soils. Also included are a soil that is 40 to 50 inches to bedrock and a soil that is underlain by soft, rippable bedrock. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is slow. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table and low strength.

This soil has good potential for cultivated crops. It is suited to most cultivated crops that are grown in the area. It can be cultivated intensively without significant loss of soil because the hazard of erosion is slight. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of cover crops and return of crop residue to the soil increase the content of organic matter and improve the tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area, but some deep rooted crops die after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil. The control of undesirable species is a concern in woodland management.

This soil has good potential for most urban uses. Because this soil is nearly level and above the flood plain, it is a good site for buildings. Slow permeability and a seasonal high water table perched above the fragipan are severe limitations for septic tank filter fields. These limitations can be overcome by enlarging the absorption area or by modifying the filter field. The seasonal high water table occurs mostly in winter and early in spring and is a

limitation for many uses. This soil is suited to most uses that are restricted to dry periods. Good design and careful installation overcome the low strength of this soil. The depth to bedrock is a limitation for uses that require deep excavations. Capability subclass IIw; woodland ordination symbol 3o.

SaB—Sadler silt loam, 2 to 6 percent slopes. This deep, moderately sloping, moderately well drained soil is on broad hilltops, saddles, and terraces throughout the central and southern parts of Muhlenberg County.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 45 inches. It is brown silt loam to a depth of 22 inches; pale brown, brown, and strong brown silt loam to a depth of 25 inches. Below 25 inches and to a depth of 45 inches is a very firm, brittle, compact fragipan of strong brown, brown, and light brownish gray silt loam. The substratum, to a depth of 60 inches, is light silty clay loam that has strong brown and light brownish gray mottles. Sandstone bedrock is at a depth of 60 inches.

Included with this soil in mapping are small eroded areas that have the original topsoil mixed with the subsoil. Also included are small areas of Zanesville, Grenada, Calloway, and Belknap soil, a soil that is 40 to 50 inches to bedrock, and a soil that is underlain by soft, rippable bedrock. In some places the surface layer has been altered by an overwash of coal and debris from adjacent mines. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength and a seasonal high water table.

This soil has good potential for cultivated crops. It is suited to most crops that are grown in the area, but the hazard of erosion is moderate when the soil is cultivated. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, and the addition of organic matter, and including grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes grown in the area (fig. 13), but some deep rooted crops die after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Most trees that are common to the area grow well on this soil. The control of undesirable species is a concern in woodland managment.

This soil has good potential for most urban uses. Because this soil is gently sloping and above the flood plain, it is a good site for buildings. Depth to bedrock is a limitation for uses that require deep excavation. Slow permeability and the seasonal water table perched above the fragipan are severe limitations for septic tank filter fields, but these limitations can be overcome by enlarging the absorption area or by modifying the filter field. The seasonal high water table occurs mostly in winter and early in spring and is a limitation for many uses. This soil is suited to most uses that are restricted to dry periods. Good design and careful installation can overcome the low strength of this soil. Capability subclass IIe; woodland ordination symbol 3o.

Ud—Udorthents. This miscellaneous area consists of strip mine spoil, which is material that has been moved in the mining of coal. The spoil is made up of rock fragments, soil material, and coal in a mixture of variable composition. In most places the material is about 40 to 80 percent rock fragments that range from 1/8 inch to 36 inches in diameter. These rock fragments include sandstone, siltstone, limestone, and shale. The fines are mostly clayey, but in places they are loamy or sandy. Reaction ranges from extremely acid to mildly alkaline. Thickness of the material ranges from 15 to 100 feet. In places the material contains coal and pyritic material and other material, locally called copperas, which is toxic to plants for a few years after mining operations have ceased.

Slopes are variable but range from 3 to 70 percent. Some areas have short and very steep slopes where the material mined several years ago was left as it was piled when mined (fig. 14). The soils are gently sloping to moderately steep where the material was mined more recently and the areas smoothed. Areas that have not been smoothed are too stony and steep for vehicular traffic, and travel by foot is difficult in places. In places pits remain that contain water. In some pits, water is toxic to aquatic life for several years after mining operations have ceased.

This soil material has poor potential for cultivated crops. Rock fragments limit this use even if the soil has been smoothed. Very large amounts of fertilizer and, in some places, lime are needed to produce average yields.

This soil material has poor potential for hay and pasture. Most areas grow grasses and legumes and produce pasture if very large amounts of fertilizer and, in places, lime are applied. The large amount of rock fragments, however, makes mowing and seedbed preparation difficult even in smoothed areas. Slopes are too steep for mowing or seedbed preparation in areas that have not been smoothed.

This soil material has fair potential for woodland. Trees grow in most areas, and shrubs grow well in many areas. The soil has good potential for wildlife habitat.

This soil material has poor potential for most urban uses because of the large amount of coarse fragments and, in most places, clayey texture of the fines. Extensive leveling and grading are needed for some uses. Not as-

signed to a capability subclass; no woodland ordination symbol.

Vc—Vicksburg silt loam. This deep, nearly level, well drained soil is on flood plains and formed in recent alluvium. It is in narrow valleys, near the base of hills, or in narrow strips near large streams. It is near upland soils that formed in loess or partly in loess. The mapped areas range from 10 to 30 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 30 inches and is brown silt loam. The substratum, to a depth of 60 inches, is brown silt loam that has pale brown and light gray mottles.

Included with this soil in mapping are small areas of Collins, Clifty, Belknap, Nolin, and Lindside soils. Also included is a soil that has more sand throughout the profile than the Vicksburg soil, a soil that is stratified throughout the profile, and a soil that has more clay in the subsoil than this Vicksburg soil. The included soils make up about 15 to 20 percent of the map unit.

Permeability is moderate, and runoff is slow. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It is subject to flooding.

This soil has good potential for cultivated crops. It can be cultivated in short rotation without loss of soil. The hazard of erosion is slight. The soil is subject to flooding, but most floods are of short duration and occur in winter or spring when row crops are not growing. Most crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of cover crops and return of crop residue to the soil increase the content of organic matter and improve the tilth.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. In places perennials are damaged by floods. The common management needs of hay and pasture apply to grasses and legumes grown on this soil. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees, and most trees native to the area grow well. Tree seeds and seedlings survive and grow well if competing tree species, shrubs, and vines are controlled or removed by site preparation, spraying, cutting, or girdling. Erosion generally is not a problem.

This soil has poor potential for most urban uses because of the hazard of flooding. In most years flooding occurs in winter and spring and is of short duration. In most places urban structures can be protected from flooding by the use of dikes and levees. Capability class I; woodland ordination symbol 1o.

Wa—Waverly silt loam. This deep, nearly level, poorly drained soil is on flood plains and formed in recent alluvium. It is in wide valleys near upland soils that formed in loess. The mapped areas range from 5 to 80 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil extends to a depth of 30 inches. It is light brownish gray silt loam that has yellowish brown and gray mottles. The substratum, to a depth of 60 inches, is light gray silt loam that has pale brown and dark brown mottles.

Included with this soil in mapping are a few areas of the Belknap soil, a soil that is 18 to 30 percent clay, and a soil that is 15 to 25 percent fine sand and medium sand in the subsoil. Also included is a soil that is slightly acid in the subsoil. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate, and runoff is slow. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. The surface layer is strongly acid or very strongly acid unless limed. This soil has a seasonal high water table and is subject to flooding.

This soil has fair potential for cultivated crops. The hazard of erosion is slight, and the soil can be cultivated intensively without loss of soil. Most flooding occurs in winter or spring when crops are not growing. Most row crops that are in the area can be grown on this soil if it is adequately drained. Crops respond to the application of fertilizer and lime. The use of cover crops and the return of crop residue to the soil are important management practices.

This soil has fair potential for hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage lowers the water table and improves the suitability of most plants. In some places grasses and legumes are damaged by flooding. The use of suitable plants, use of proper seeding rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees, and some areas are in native hardwoods. Most species that are suited to wet soils in the area grow well on this soil. Undesirable species of trees, vines, and shrubs can be controlled by thinning, site preparation, cutting, spraying, or girdling. Seedlings have low survival. Most trees are harvested in summer or fall, because the use of equipment is limited in wet periods. Erosion generally is not a problem.

This soil has poor potential for urban uses because of the hazard of flooding and the seasonal high water table. Most of this soil is commonly flooded in winter. In most places, however, urban improvements can be protected by the use of dikes and levees. The soil is saturated with water for several weeks. Excess water can be removed by drainage, but drainage may not be practical for some uses. This soil is suited to most uses that are restricted to dry periods. Capability subclass IIIw; woodland ordination symbol 1w.

Wd—Waverly silt loam, depressional. This deep, nearly level soil is in low areas that are covered with water most of the time. The water is 1 foot to 4 feet deep, and does not drain off because there are no drainage channels or the channels have been blocked. The soil is in wide valleys near soils on uplands that formed in loess. Most areas of this soil have been ponded for many years, but some areas have been ponded for only a few years.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil extends to a depth of 30 inches. It is light brownish gray silt loam that has yellowish brown and gray mottles. The substratum, to a depth of 60 inches, is light gray silt loam that has pale brown and dark brown mottles.

Included with this soil in mapping are areas of Belknap, Melvin, and Karnak soils. Also included are areas that have an overwash that contains fragments of sandstone, shale, and coal. The included soils make up 20 to 30 percent of the map unit.

This soil has a sparse vegetation of willows, cattails, and water-tolerant shrubs (fig. 15). In places, dead trees still stand in water. Because the water is now deeper, or stands longer on the soil than it did a few years ago, these trees could not survive. In some places near coal mines, the soil receives runoff that may be toxic to some plants. Fish, turtles, and other aquatic animals live in some places.

This soil is not suited to cultivated crops or to grasses and legumes unless it is drained. Some areas of this soil were cultivated before they became ponded.

In its present condition, this soil is not suited to trees generally grown in the area because of the amount of water on the soil; however, water-tolerant trees, for example, cypress, probably will grow on this soil. If the soils were drained, other hardwoods that are native to the area would grow.

This soil has poor potential for most urban uses. In addition to excess water, a high water table and the hazard of flooding limit the use of this soil for most urban development. The soil has good potential for wetland wildlife and for some recreational uses. Capability subclass Vw. No woodland ordination symbol.

We—Weinbach silt loam. This deep, nearly level, somewhat poorly drained soil is on stream terraces and formed in alluvium deposited by large streams. It is mostly on low convex ridges that are 200 to 800 feet wide and 1,000 to 4,000 feet long.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 56 inches. The upper part is mottled gray, pale brown, and yellowish brown silt loam to a depth of 26 inches; the lower part, to a depth of 56 inches, is a compact fragipan that is grayish brown silty clay loam and mottled yellowish brown and light gray silt loam. The substratum is mottled yellowish brown and light gray silt loam to a depth of 70 inches.

Included with this soil in mapping is a soil that is medium acid to neutral in the substratum. Also included are a soil that has a thicker subsoil than the Weinbach soil, a soil that has a weakly developed fragipan, small areas of Otwell, Newark, and Melvin soils, and small areas of a poorly drained soil on stream terraces. The included soils make up about 15 to 25 percent of the map unit.

Permeability is moderate above the fragipan and slow in the fragipan. Runoff is slow. Available water capacity is moderate, and the root zone is moderately deep to the fragipan. Organic-matter content is low. This soil is strongly acid or very strongly acid unless limed. It has good tilth and good workability. It has a seasonal high water table perched above the fragipan. Some areas of this soil are infrequently flooded. The soil has low strength.

This soil has fair potential for cultivated crops. Because the hazard of erosion is slight, this soil can be cultivated in short rotation. It is not well suited to crops that require a well drained soil because it has a seasonal high water table. The soil can be worked within wide range of moisture content without crusting or clodding. Crops respond well to applications of lime and fertilizer. Most row crops that are common to the area can be grown on this soil; however, drainage improves the suitability of some crops. The use of cover crops and return of crop residue to the soil are important management practices.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. It is not well suited to plants that require a well drained soil because of moderate depth to the fragipan and the seasonal high water table. Most plants grow better where the excess surface water has been removed. The use of proper seeding rates, application of lime and fertilizer, control of grazing, and control of weeds are important management practices.

This soil has good potential for trees. Most species that are suited to wet soils grow well on this soil. Undesirable species of trees, shrubs, and vines can be controlled by site preparation, spraying, cutting, or girdling. Most trees are harvested in summer and fall, because the soil is wet in the winter. Erosion generally is not a problem.

This soil has poor potential for urban uses, because of the hazard of flooding and the seasonal high water table. Floods on most areas of this soil are rare; however, the floods last for several days. Most permanent urban structures can be protected from floods by the use of dikes and levees. The subsoil is saturated with water for several weeks during most winters. Slow permeability in the fragipan is a limitation for septic tank filter fields. Capability subclass IIIw; woodland ordination symbol 2w.

WIB—Wellston silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is mainly on hilltops in the southern part of Muhlenberg County. Slopes are convex. Most areas are long, narrow, and winding and are mainly 200 to 500 feet wide and 5 to 20 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown silt loam to a depth of 30 inches; the lower part is mottled brown and light gray silt

loam to a depth of 40 inches. The substratum, to a depth of 52 inches, is yellowish brown loam that has light brownish gray mottles. Soft sandstone bedrock is at a depth of about 52 inches.

Included with this soil in mapping are small areas of Zanesville, Lenberg, and Frondorf soils. Also included is a Wellston soil that has slopes of 6 to 10 percent, a soil that has lost the original surface layer through erosion, a soil that is extremely acid in the substratum, and a soil that is underlain by soft, rippable bedrock. The included soils make up about 20 to 25 percent of the map unit.

Permeability is moderate, and runoff is medium. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength.

This soil has good potential for cultivated crops. The hazard of erosion is moderate in cultivated areas. This soil is suited to most cultivated crops that are grown in the area. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees, and a few areas are in native hardwoods. Tree seedlings of most species that are common to the area survive and grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling.

This soil has good potential for most urban uses. Because the soil is on hilltops, it can be a good site for buildings. Depth to bedrock is a limitation for some uses, for example, buildings with basements and sanitary facilities. In some places, however, the bedrock can be excavated with earth-moving equipment. Precautionary measures need to be taken to prevent erosion during construction. Capability subclass IIe; woodland ordination symbol 2o.

WIC—Wellston silt loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is on hilltops and side slopes on uplands mainly in the central and southern parts of Muhlenberg County. The soils on hilltops are in convex areas that are 200 to 500 feet wide, and the soils on side slopes are in areas that are 100 to 500 feet wide and extend several hundred feet around the hill. The mapped areas are 5 to 50 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown silt loam to a depth of 30 inches; the lower part, to a depth of 40 inches, is mottled brown and light gray silt loam. The substratum, to a depth of 52 inches, is yellowish brown loam that has light brownish gray mottles. Soft sandstone bedrock is at a depth of 52 inches.

Included with this soil in mapping are small areas of Frondorf, Lenberg, Zanesville, and Belknap soils. Also included are a deep soil that has a silty clay substratum, a soil that is underlain by soft, rippable bedrock, and a soil that is extremely acid in the substratum. Some soils that have greater slope and some soils that have less slope than this Wellston soil are included. Small areas of a soil that is severely eroded and that has a thinner surface layer and subsoil than this Wellston soil are also included. Some severely eroded soils are identifed on the soil map with a spot symbol. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate, and runoff is medium. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength.

This soil has fair potential for cultivated crops. It is suited to most cultivated crops that are grown in the area. The hazard of erosion is severe when this soil is cultivated. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, the addition of organic matter, and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees, and most native trees grow well. Tree seeds and seedlings survive and grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling. Erosion generally is not a problem.

This soil has fair potential for most urban uses. Because of slope, grading and leveling are needed for some urban uses. Precautionary measures need to be taken to prevent erosion during construction. Temporary plant cover helps control erosion until permanent cover can be established. Depth to bedrock is a limitation for some uses, for example, buildings with basements and sanitary facilities. In some places bedrock can be excavated with earth-moving equipment. Capability subclass IIIe; woodland ordination symbol 2o.

WIC3—Wellston silt loam, 6 to 12 percent slopes, severely eroded. This deep, well drained, sloping soil is on hillsides and hilltops mainly in Muhlenberg County. The mapped areas range from 5 to 30 acres in size, and many areas have hillside draws. The original surface layer has been removed by erosion from more than 30 percent of

the area, and in places part of the subsoil has been removed. In places shallow rills and gullies 2 to 3 feet deep make up 10 to 20 percent of the area.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 32 inches. It is strong brown silt loam to a depth of 22 inches, and mottled brown and light gray silt loam to a depth of 32 inches. The substratum, to a depth of 44 inches, is yellowish brown loam that has light brownish gray mottles. Soft sandstone bedrock is at a depth of 44 inches.

Included with this soil in mapping are small areas of Zanesville, Frondorf, Lenberg, Collins, and Belknap soils. Also included are some areas of Wellston soils that are not eroded; a soil that is extremely acid in the substratum; a soil that has a surface layer of light silty clay loam; and a soil that is underlain by soft, rippable bedrock. A soil that has more sand throughout the profile, a soil that has more coarse fragments in the upper part of the profile, and a soil that has more clay in the lower part of the subsoil than this Wellston soil are also included. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate, and runoff is medium. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength.

This soil has fair potential for cultivated crops. The hazard of erosion is very severe when the soil is cultivated. Most cultivated crops that are grown in the area grow well on this soil. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, addition of organic matter, and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Some areas of soil that are no longer cultivated are revegetating naturally with trees and shrubs. Desirable trees grow well if competing vegetation is removed or controlled by site preparation, spraying, cutting, or girdling. Slopes generally do not limit the use of equipment.

This soil has fair potential for most urban uses. Because of slope, grading and leveling are needed for some uses. Depth to bedrock is a limitation for such urban uses as buildings with basements and sanitary facilities. In some places bedrock can be excavated with earth-moving equipment. Precautionary measures need to be taken to prevent erosion during construction. Temporary vegetation helps control erosion until permanent cover can be established. Capability subclass IVe; woodland ordination symbol 2o.

WlD—Wellston silt loam, 12 to 20 percent slopes. This deep, moderately steep, well drained soil is on uplands mainly in the central and southern parts of Muhlenberg County and in the hilly parts of McLean County. It is on hillsides in areas that are 100 to 500 feet wide and extend several hundred feet around the hill. The mapped areas range from 5 to 50 acres in size. Many large areas are dissected by drainageways.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown silt loam to a depth of 30 inches; the lower part, to a depth of 40 inches, is mottled brown and light brownish gray silt loam. The substratum, to a depth of 52 inches, is yellowish brown and light brownish gray mottled loam. Soft sandstone bedrock is at a depth of 52 inches.

Included with this soil in mapping are small areas of Frondorf, Lenberg, Zanesville, and Belknap soils that are mainly along drainageways. Also included are a soil that has a silty clay substratum; a soil that is extremely acid in the substratum; and a soil that is underlain by soft, rippable bedrock. Some areas of soils that have greater slope or less slope than this Wellston soil and small areas of a soil that is severely eroded and that has a thinner surface layer and subsoil than this Wellston soil are included. Some severely eroded soils are identified on the soil map with a spot symbol. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate, and runoff is rapid. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength.

This soil has fair potential for cultivated crops. The erosion hazard is very severe when this soil is cultivated. Most cultivated crops that are common to the area grow well on this soil. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, the addition of organic matter, and including grasses and legumes in the rotation help reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees, and many areas are in hardwoods. Most trees that are suited to uplands grow well on this soil. Undesirable species can be controlled or removed by site preparation, spraying, cutting, or girdling. Trees grow better on north-facing slopes than on south-facing slopes. The moderately steep slopes cause an erosion hazard and limit the use of equipment.

This soil has poor potential for urban uses because of slope and depth to bedrock. For most urban uses, considerable grading and leveling are possible to reduce the slope. Bedrock at a depth of 40 to 72 inches limits the amount of grading and leveling needed, but in some places the bedrock can be excavated with heavy equipment. If this soil is used for construction, precautionary measures need to be taken to prevent erosion. Capability subclass IVe; woodland ordination symbols: north aspect 2r; south aspect 3r.

WID3—Wellston silt loam, 12 to 30 percent slopes, severely eroded. This deep, well drained, moderately steep and steep soil is on hillsides throughout the survey area. The mapped areas range from 5 to 50 acres in size, and many areas are crossed by draws. The original surface layer of this soil and, in places, part of the subsoil have been removed by erosion from more than 30 percent of the area. Rills and shallow gullies 2 to 3 feet deep make up less than 20 percent of the area.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 32 inches. The upper part is strong brown silt loam to a depth of 22 inches; the lower part is mottled brown and light gray silt loam to a depth of 32 inches. The substratum, to a depth of 44 inches, is yellowish brown loam that has light brownish gray mottles. Soft sandstone bedrock is at a depth of 44 inches.

Included with this soil in mapping are small areas of Memphis, Loring, Zanesville, Frondorf, Lenberg, Clifty, and Belknap soils. Also included are some Wellston soils that are not eroded, a Wellston soil that has a surface layer of light silty clay loam, and a soil that has more coarse fragments in the upper part of the profile than this Wellston soil. A soil that has a thin layer of water-laid gravel between the subsoil and bedrock, a soil that is extremely acid in the substratum, and a soil that is underlain by soft, rippable bedrock are included. Included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate, and runoff is rapid. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength.

This soil has poor potential for cultivated crops. Most crops that are common to the area grow well on this soil, but most of the soil is not suitable for cultivation, because of the hazard of erosion.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs. Erosion control measures are needed during seedbed preparation.

This soil nas fair potential for trees, and many areas are in hardwoods. Most trees that are suited to uplands in the area grow well on this soil. Undesirable species can be controlled or removed by site preparation, spraying, cutting, or girdling. Trees grow better on north-facing slopes than on south-facing slopes. The moderately steep slopes cause an erosion hazard and limit the use of equipment.

This soil has poor potential for urban uses because of slope and depth to bedrock. For most urban uses, considerable grading and leveling are needed to reduce the slope. Bedrock at a depth of 40 to 72 inches limits the amount of grading and leveling possible, but in some places the bedrock can be excavated with heavy equipment. If this soil is used for construction, precautionary measures need to be taken to prevent erosion. Capability subclass VIe; woodland ordination symbols: north aspect 2r; south aspect 3r.

WIE—Wellston silt loam, 20 to 30 percent slopes. This deep, well drained, steep soil is on hillsides mainly in McLean County and in the northern part of Muhlenberg County. The mapped areas range from about 5 to 100 acres in size, and most large areas have drainageways. Slopes are mostly 200 to 600 feet long.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown silt loam to a depth of 30 inches; the lower part, to a depth of 40 inches, is mottled brown and light brownish gray silt loam. The substratum, to a depth of 52 inches, is yellowish brown loam that has light brownish gray mottles. Soft sandstone bedrock is at a depth of 52 inches.

Included with this soil in mapping are small areas of Memphis, Loring, Frondorf, and Lenberg soils, and some Vicksburg, Collins, and Belknap soils in drainageways. Also included are some small, severely eroded areas that have more clay in the surface layer, and a soil that has more sand throughout the profile than this Wellston soil. Some severely eroded areas are identified on the soil map with a spot symbol. A soil that has more clay in the lower part of the subsoil, a soil that has some water-laid gravel in the substratum, a soil that is extremely acid in the substratum, and a soil that is underlain by soft, rippable bedrock are also included. The included soils make up about 20 to 30 percent of the map unit.

Permeability is moderate, and runoff is rapid. The root zone is deep. Available water capacity is high. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has low strength.

This soil has poor potential for cultivated crops. Most crops that are common to the area grow well on this soil, but the severe hazard of erosion makes this soil generally unsuited to cultivation.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. The use of proper seeding mixtures and rates, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs. Erosion control measures are needed during seedbed preparation.

This soil has fair potential for trees, and most areas are in hardwoods. Most trees that are native to the area grow

well on this soil. Trees grow better on north-facing slopes than on south-facing slopes. Desirable species grow well if competing vegetation is controlled or removed by site preparation, spraying, cutting, or girdling. The use of planting, managing, and harvesting equipment is limited by steep slopes. Erosion is a hazard along haul roads and skidtrails.

This soil has poor potential for urban uses because of slope and depth to bedrock. For most urban uses, considerable grading and leveling are needed to reduce the slope, but bedrock at a depth of 40 to 72 inches limits the amount of grading and leveling possible. In some places, however, the bedrock can be excavated with heavy equipment. If this soil is used for construction, precautionary measures need to be taken to prevent erosion. Capability subclass VIe; woodland ordination symbols: north aspect 2r; south aspect 3r.

ZaB—Zanesville silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained to moderately well drained soil is on hilltops and on some toe slopes. It is on uplands mainly in the central and southern parts of Muhlenberg County. Slopes are mostly convex. Many mapped areas on hilltops are long and winding and are 200 to 500 feet wide. The mapped areas range from 5 to 30 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown heavy silt loam to a depth of 30 inches; the lower part is a firm, brittle and compact fragipan of mottled yellowish brown, brown, and light gray silt loam and extends to a depth of 40 inches. The fragipan extends into the upper part of the substratum to a depth of 50 inches and is yellowish brown silt loam. Below the fragipan the substratum is mottled yellowish brown and reddish brown light clay loam. Sandstone bedrock is at a depth of 70 inches.

Included with this soil in mapping is a soil in small areas where the original surface layer is mixed with the subsoil. The present surface layer of this included soil is brighter colored and is slightly less friable than the surface layer of this Zanesville soil. Also included are a soil that is underlain by soft rippable bedrock, a few small areas of Wellston soils on points of ridges, and small areas of Sadler and Loring soils. The included soils make up about 20 to 25 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow and slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Content of organic matter is low, and natural fertility is medium. The soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table and is low in strength.

This soil has good potential for cultivated crops and is suited to most cultivated crops that are grown in the survey area. The hazard of erosion is moderate in cultivated areas. Crops respond well to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour farming, stripcropping, cover crops, grassed waterways, addition of organic matter, and including grasses and legumes in the rotation help to reduce runoff and control erosion (fig. 16).

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep-rooted crops die out within a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most trees that grow on uplands in the survey area grow well on this soil. A few small areas of this soil remain in native hardwoods. Young trees survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil has good potential for most urban uses. Because it is gently sloping and is on uplands, it is favorable for building sites. Slow permeability and the seasonal perched water table above the fragipan are severe limitations for septic tank filter fields, but these limitations can be overcome by enlarging the absorption area or by modifying the filter field. Depth to bedrock is a limitation for sanitary facilities, buildings with basements, and other structures that require deep excavation. The seasonal high water table occurs mainly in winter and early in spring and is a limitation for some uses. The low strength of this soil can be overome by good design and careful installation. Capability subclass IIe; woodland ordination symbol 3o.

ZaC—Zanesville silt loam, 6 to 12 percent slopes. This deep, sloping, well drained to moderately well drained soil is on hilltops and on toe slopes mainly in the central and southern parts of Muhlenberg County. Most mapped areas range from 5 to 40 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown heavy silt loam to a depth of 30 inches; the lower part, to a depth of 40 inches, is a mottled yellowish brown, brown, and light gray heavy silt loam fragipan. The fragipan extends into the upper part of the substratum to a depth of 50 inches and is yellowish brown silt loam. Below the fragipan, the substratum, to a depth of 70 inches, is mottled yellowish brown and reddish brown light clay loam. Sandstone bedrock is at a depth of 70 inches.

Included with this soil in mapping are small areas of a soil where the original surface layer has been mixed with the subsoil. The present surface layer of this included soil is eroded and brighter colored than this Zanesville soil. Also included are small areas of a soil that has shallow gullies, a few small wet spots, and a few small areas of soils that have slopes of less than 6 percent. Small areas of Sadler and Loring soils, a soil that is silty clay in the substratum, and a soil that is underlain by soft rippable

bedrock are also included. The included soils make up about 20 to 25 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow to slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. Available water capacity is moderate. Organic-matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table and low strength.

This soil has fair potential for cultivated crops. It is suited to most crops that are grown in the area, but the hazard of erosion is severe if the soil is cultivated. Crops respond to the application of lime and fertilizer. The plow layer is easy to till and can be worked within a wide range of moisture content. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, and the addition of organic matter, and including grasses and legumes in the rotation help to reduce runoff and control erosion.

This soil has good potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep rooted crops die within a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has good potential for trees. Most trees that grow on uplands in the area grow well on this soil. A few small areas of this soil remain in native hardwoods (fig. 17). Young trees survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil has good potential for most urban uses. Because it is on uplands, it is a favorable site for buildings. Grading and leveling are needed for some urban uses because of slope, but the amount of grading and leveling needed is limited in some places by depth to bedrock. Slow permeability in the fragipan is a severe limitation for septic tank filter fields. Water saturates the layer above the fragipan in wet periods, but generally this limitation can be overcome by good design and installation. Capability subclass IIIe; woodland ordination symbol 3o.

ZaC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This deep, sloping, well drained to moderately well drained soil is mainly on side slopes in Muhlenberg County. Erosion has removed the original surface layer from more than 30 percent of the area, and in some places part of the subsoil has been removed. Some places have shallow gullies 2 to 3 feet deep that make up 10 to 20 percent of the survey area.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 25 inches. The upper part is strong brown heavy silt loam to a depth of 15 inches; the lower part is a mottled brown, yellowish brown, and light gray heavy silt loam firm, brittle, compact fragipan to a depth of 25 inches. The lower part of the fragipan is yellowish brown silt loam and extends into the substratum to a depth of 35 inches. Below the fragipan the substratum, to a depth of 55 inches, is mottled yellowish brown and reddish brown light clay loam. Sandstone bedrock is at a depth of 55 inches.

Included with this soil is mapping are some areas of Sadler, Wellston, and Loring soils. Some areas include uneroded soils between gullies and near the bottoms of slopes. Also included is a soil that has a substratum of silty clay, a soil that is 30 to 40 inches to bedrock in the most severely eroded places, and a soil that is underlain by soft, ripable bedrock. Long narrow bands of Belknap and Collins soils along waterways and in low places, and some Zanesville soils that have 4 to 6 percent slopes or 12 to 15 percent slopes are also included. Included soils make up about 20 to 25 percent of the map unit.

Permeability is moderate above the fragipan and moderately slow to slow in the fragipan. Runoff is medium. The root zone to the fragipan is shallow. Available water capacity is low. Organic-matter content is low, and natural fertility is medium. The soil is strongly acid or very strongly acid unless limed. It has a seasonal high water table and low strength.

This soil has poor potential for cultivated crops. The hazard of erosion is very severe when the soil is cultivated. The use of minimum tillage, contour cultivation, stripcropping, cover crops, grassed waterways, the addition of organic matter, and including grasses and legumes in the rotation help to reduce runoff and erosion.

This soil has fair potential for hay and pasture. It is suited to most grasses and legumes that are grown in the area. Some deep rooted crops die after a few years. The use of proper seeding rates and mixtures, application of lime and fertilizer, control of weeds, and control of grazing are the main management needs.

This soil has fair potential for trees. Vegetation in some areas is returning naturally to trees and shrubs after cultivation of the soil has been abandoned. Seedling mortality is a limitation on this soil. Generally, slope does not limit the use of equipment or cause a hazard of erosion.

This soil has fair potential for most urban uses. Because of slope, grading and leveling are needed for some urban uses, but the amount of grading and leveling is limited in some places by depth to bedrock. Excess water above the fragipan is a limitation that can be overcome by good design and installation. Capability subclass IVe; woodland ordination symbol 4d.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of

behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Roscoe Isaacs, assistant State resource conservationist, Soil Conservation Service, assisted in preparing this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices. The information is useful to equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms, should also consider the detailed information given in the description of each soil.

The acreage of potential cropland and pastureland is being reduced in the survey area. Most developed areas are on soils that have good potential for both cropland and pastureland. Some areas of strip mining are on soils that have good potential for either cropland or pasture. About 44,890 acres had been strip mined in 1976. Some soils, especially soils that can be drained, are being converted from woodland to cropland. There is a net loss of potential cropland and pastureland. The use of this soil survey to help make land use decisions is discussed in the section "General soil map for broad land use planning."

In 1967, more than 236,347 acres in the survey area was used for crops and pasture, according to the Conservation Needs Inventory. Of this total, 94,007 acres was used for row crops, mostly corn and soybeans; 4,431 acres for close-growing crops, mostly wheat; 68,428 acres for rotation hay and pasture; 42,613 acres for permanent pasture; and 311 acres for orchards. The rest was idle cropland.

The potential of the soils in McLean and Muhlenberg Counties for increased production is good. In 1967, about 31,132 acres of potentially good cropland was in woodland and about 20,370 acres in permanent pastureland. In addition to the reserve productive capacity, food production could also be increased by the use of the latest production technology. This soil survey can be used to apply technology to produce crops and pasture more efficiently.

Soil erosion is a major soil problem on uplands in McLean and Muhlenberg Counties. If the slope is more than 2 percent, erosion is a hazard. Grenada, Loring, Memphis, Wellston, and Zanesville soils, for example, have slopes greater than 2 percent. Of the soils in the survey area, 299,610 acres have slopes greater than 2 percent. About 80 percent of these soils are suited to crops or pasture.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced where the surface layer is lost. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Caneyville and Lenberg; and to soils that have a layer in the subsoil that limits the root zone. Such layers are the fragipan in the Loring, Grenada, Sadler, and Zanesville soils, and the bedrock in the Frondorf, Caneyville, and Lenberg soils. Second, soil erosion causes sediment to enter streams. Control of erosion helps prevent the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps plant cover on the soil holds erosion

losses to amounts that will not reduce the productive capacity of the soils. On livestock farms which require pasture and hay, grass and legume forage crops in the cropping system reduce erosion on sloping land and provide nitrogen and improve tilth for the following crop.

Because slopes are short and irregular, contour tillage or terracing is not practical in some areas of the soils. On these soils, cropping systems that provide substantial plant cover are needed to control erosion unless minimum tillage is practiced. Minimum tillage and leaving crop residue on the surface help increase infiltration and reduce runoff and the hazard of erosion on most soils. Not tilling corn and soybeans is an effective measure in reducing erosion on sloping land and can be used on most soils in the survey area.

Terraces are diversions which shorten the length of slope and reduce runoff and soil erosion are most practical on deep, well drained soils that have uniform slopes. Many areas of Memphis, Wellston, Loring, Grenada, and Zanesville soils are suitable for terraces.

Contour cultivation and contour stripcropping are erosion control measures that are suitable for those soils that have smooth, uniform slopes. Most of the upland soils in the survey area are suited to contour cultivation and contour stripcropping.

Information about the design of erosion control measures for each kind of soil is available in local offices of the Soil Conservation Service.

Soil drainage is the major management concern on about 55 percent of the acreage used for crops and pasture in the survey area. The poorly drained Melvin, Waverly, and Karnak soils are naturally so wet that the production of crops common to the area is not feasible unless the soils are drained. These soils make up 63,150 acres in the survey area.

The somewhat poorly drained Newark, Belknap, Weinbach, Calloway, McGary, and Henshaw soils are so wet that crops are damaged during most years unless they are artificially drained. These soils make up about 83,740 acres in the survey area.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of open drainage ditches and tile drainage provides good drainage for most soils. Tile drains are less effective and generally are more closely spaced in soils that have slow permeability than in the more permeable soils. Suitable outlets are needed for both surface drains and tile drains.

Soil fertility is naturally low in most soils in the survey area. These soils are low in phosphate and potash, and most of the soils are naturally acid.

The soils on uplands and stream terraces and some of the soils on flood plains are naturally strongly acid or very strongly acid. However, some soils on flood plains below outcrops of limestone in the southwestern part of Muhlenberg County and in the Green River Valley, for example, the Nolin, Lindside, Newark, Melvin, and Karnak soils are medium acid to neutral. Some soils on stream terraces, for example, the Henshaw, Markland, and McGary soils are slightly acid to moderately alkaline in a few severely eroded places. The soils that are naturally strongly acid or very strongly acid make up about 86 percent of the survey area.

Most of the soils require applications of ground limestone to raise the pH level for good growth of alfalfa and other crops that grow only on nearly neutral soils. Available phosphorus and potasssium are naturally low on most of these soils. On all soils, additions of limestone and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can assist in determining the kinds and amounts of fertilizer and limestone to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Most of the soils used for crops in the survey area have a silt loam surface layer that is light in color and low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes the formation of a hard surface crust that is nearly impervious to water when the soil is dry. This crust reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material help to improve soil structure and reduce crust formation.

Because a crust forms during the winter and spring, fall plowing generally is not a good management practice on the light colored soils that have a silt loam surface layer. If these soils are plowed in the fall, many of then are nearly as dense and hard at planting time as they were before plowing. In addition, about half of the cropland is made up of sloping soils, and these soils are subject to damaging erosion if they are plowed in the fall.

Fall plowing generally results in good tilth in the spring for the Karnak silty clay soils. Those soils are clayey, and tilth is a problem because the soils often stay wet until late in spring. If they are wet when plowed, they become very cloddy when dry and good seedbeds are difficult to prepare.

Field crops suited to the soils and climate of the survey area include many crops that are not commonly grown. Corn and soybeans are the main row crops. Grain sorghum, popcorn, sunflowers, navy beans, sugar beets, peanuts, potatoes, and similar crops also are suited to these soils.

Wheat is the main close growing crop. Rye, barley, and oats are also grown. Grass and legume seed, produced from bromegrass, tall fescue, redtop, bluegrass, lespedeza, and clover, also are suited to these soils.

Tobacco is the main special crop; 1,370 acres of tobacco were grown in McLean and Muhlenberg Counties in 1973. Most families have home gardens, and a few families have small orchards. Melons, strawberries, raspberries, sweet corn, tomatoes, and blackberries are grown.

Apples, peaches, pears, cherries, and plums are important tree fruits.

Deep soils that have good natural drainage and warm up early in the spring, for example, the Elk, Memphis, and Wellston soils are well suited to many vegetables, small fruits, and tobacco. Soils that are moderately deep and moderately well drained, including the Loring, Grenada, Sadler, Zanesville, and Otwell soils, are also used for these crops. Soils on flood plains that are well drained and moderately well drained can be used for special crops if these soils are protected from flooding.

The local offices of the Cooperative Extension Service and the Soil Conservation Service can provide information and suggestions for growing special crops.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system as used in this survey area, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 6. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Woodland management and productivity

The soil in McLean and Muhlenberg Counties was originally covered with hardwood forest. Dominant species of trees were oak, hickory, elm, ash, maple, beech, gum, cottonwood, yellow-poplar, and black walnut.

Early settlers cleared and farmed the land. By the beginning of the twentieth century most of the upland soils and much of the bottom land soils that were well suited to farming had been cleared. Most steep soils and many areas of poorly drained soils have not yet been cleared. All woodland in the two counties is privately owned except some acreage in Lake Malone State Park in the southern part of Muhlenberg County. According to the Conservation Needs Inventory in 1967, there were 140,900 acres of woodland in Muhlenberg County and 45,500 acres in McLean County.

Several sawmills in the area cut rough lumber to be used for barn patterns, bridge planks, crossties, pallets, and barrel staves. Good quality walnut, maple, oak, cherry, and poplar lumber are used for making furniture. Wood that is not suitable for other uses is used by processing plants in Hancock County for pulpwood.

Indiscriminate logging, overgrazing, and forest fires have reduced tree quality and stocking of desirable species in most stands. At the present time forest fire protection is adequate in the two counties. Most soils in these counties have the potential to produce faster growing stands of better quality than is now produced; however, better woodland management is needed to improve the stocking of desirable species. Such management should relate tree species to soil characteristics that affect tree growth, for example, available water capacity, depth of root zone, aeration, texture, and drainage.

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities; and table 11, for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of

soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and

permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones

and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity (fig. 18). Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The

surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water (*1*). If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, sur-

face stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*2*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These num-

bers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 17. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For most soils in this survey area, the swelling was estimated on the basis of the kind and amount of clay in the soil and on comparisons with similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides (fig. 19). Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Kentucky Department of Transportation.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The code for Unified classification is that assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-73); Unified classification (D-2487-66T); mechanical analysis (T88-72); liquid limit (T89-68); plasticity index (T90-70); and moisture-density, method A (T99-74).

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon

follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Belknap series

The Belknap series consists of deep, somewhat poorly drained soils that formed in acid alluvium that washed from loess. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 4 percent but are mostly 0 to 2 percent.

Belknap soils are geographically associated with Vicksburg, Collins, and Waverly soils. The Vicksburg and Collins soils are better drained and are less gray in the subsoil. Waverly soils are more poorly drained and have a higher percentage of gray in the subsoil. Newark soils are less acid and have more clay in the subsoil.

Typical pedon of Belknap silt loam, 3/4 mile south of Glenville, 300 yards north of Long Falls Creek, and 300 yards west of paved road, in McLean County:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; slightly acid; abrupt smooth boundary.

B21—8 to 12 inches; brown (10YR 4/3) silt loam; few fine distinct light gray (10YR 7/1) mottles; weak fine subangular blocky structure; very friable; few roots; very strongly acid; clear smooth boundary.

B22g—12 to 20 inches; light brownish gray (10YR 6/2) silt loam; many medium faint brown (10YR 5/3) mottles; weak medium and coarse subangular blocky structure; very friable; very strongly acid; gradual smooth boundary.

B23g—20 to 36 inches; gray (10YR 6/1) silt loam; many medium distinct pale brown (10YR 6/3) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very friable; very strongly acid; gradual smooth boundary.

Cg—36 to 60 inches; gray (10YR 6/1) silt loam; many medium distinct yellowish brown (10YR 5/4) and few fine distinct very dark grayish brown (10YR 3/2) mottles; weak coarse subangular blocky structure; very friable; few black concretionary stains; few pores that have slick surfaces; strongly acid.

The thickness of the solum ranges from 30 to 50 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. In unlimed areas reaction is strongly acid or very strongly acid throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B21 horizon mainly has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. Mottles have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. The Bg horizon has similar colors except chroma of 1 or 2 is dominant. Depth to a gleyed horizon ranges from 10 to 20 inches. The B horizon has granular or subangular blocky structure.

The Cg horizon has colors that are similar to the Bg horizon. It has subangular blocky or granular structure, or it is massive.

Calloway series

The Calloway series consists of deep, somewhat poorly drained soils that formed in loess on uplands and have a fragipan. Permeability is slow. Slopes range from 0 to 5 percent but are mostly 0 to 2 percent.

Calloway soils are geographically associated with Grenada, Loring, Zanesville, and Sadler soils. All of the associated soils are better drained and are not gray in the upper part of the subsoil. Henshaw and Weinbach soils, which are on stream terraces, are similar in drainage to Calloway soils. Henshaw soils do not have a fragipan. Weinbach soils are not bisequal and are underlain by stratified alluvium.

Typical pedon of Calloway silt loam, 0 to 2 percent slopes, 2 1/2 miles east of Bremen, 400 feet south of State Highway 175, 300 feet north of railroad tracks and 50 feet west of paved road, in Muhlenberg County:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few roots; slightly acid; clear smooth boundary.

B2—8 to 18 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few small concretions; few roots; strongly acid; clear smooth boundary.

A'2—18 to 24 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine and very fine subangular blocky structure; friable; many brown concretions; few pieces of brown (7.5YR 4/4) silt loam peds from the B horizon in the lower 2 inches; few fine pores; strongly acid; gradual wavy boundary.

B'x1—24 to 48 inches; gray (10YR 6/1) silt loam; common medium distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm, brittle, and compact; few roots between prisms; gray silt coatings on prisms; grayish brown clay in some cracks in the lower part; few patchy clay films on peds and in pores; few small pores; very strongly acid; diffuse wavy boundary.

B'x2—48 to 65 inches; mottled light gray (10YR 7/1) and yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; firm, brittle, and compact; gray silt in cracks; black concretionary stains on peds; strongly acid.

The thickness of the solum is 60 inches or more. Depth to bedrock is 60 inches or more. The thickness of the loess is more than 48 inches. Depth to the fragipan ranges from 16 to 30 inches. In unlimed areas, reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 3 to 6. Mottles have chroma of 1 or 2 and are few to many. This horizon is heavy silt loam or light silty clay loam. Some pedons have a few thin, patchy clay films.

The A'2 horizon mainly has hue of 10YR, value of 6 or 7, and chroma of 1 to 3. It is silt loam or silt.

The B'x horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 6.

Caneyville series

The Caneyville series consists of moderately deep, well drained soils that formed in residuum derived from limestone. These soils are on uplands mostly in the southwestern part of Muhlenberg County. Permeability is moderately slow. Slopes range from 6 to 30 percent.

Caneyville soils are geographically associated with Wellston, Frondorf, Lenberg, and Zanesville soils. Wellston soils are deep to sandstone and shale bedrock and have less clay in the subsoil. Frondorf soils have less clay in the subsoil and formed mostly in residuum derived from siltstone and sandstone. Lenberg soils formed in soft, acid clayey shale. Zanesville soils are deeper to bedrock and have a fragipan.

Typical pedon of Caneyville silt loam, in an area of Caneyville-Rock outcrop complex, 12 to 30 percent slopes, 3 miles southwest of Weir, 1/2 mile south of Lone Star Church, and 100 feet east of gravel road, in Muhlenberg County:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; few tree roots; partly decomposed organic matter; slightly acid; abrupt smooth boundary.

A2—2 to 5 inches; yellowish brown (10YR 5/4) silt loam; weak medium granular and subangular blocky structure; very friable; few tree roots; medium acid; clear smooth boundary.

B21t—5 to 12 inches; yellowish red (5YR 5/6) clay; moderate very fine subangular blocky structure; firm, plastic; few tree roots; old root channels filled with very dark grayish brown (10YR 3/2) silt loam; strongly acid; gradual smooth boundary.

B22t—12 to 20 inches; yellowish red (5YR 5/6) clay; many medium distinct red (2.5YR 4/6) and common medium faint yellowish brown (10YR 5/6) mottles; moderate very fine subangular blocky structure; firm, plastic; black concretionary stains; continuous clay films; few roots; 2 percent sandstone fragments 1/2 inch to 3 inches in diameter; strongly acid; gradual smooth boundary.

B23t—20 to 30 inches; light yellowish brown (10YR 6/4) clay; few fine distinct yellowish red (5YR 4/6) and common medium faint light olive brown (2.5Y 5/4) mottles; weak very fine angular blocky structure; very firm and very plastic; clumps of black concretionary stains in places; few tree roots; 1 percent sandstone fragments 1/4 inch to 2 inches in diameter; medium acid.

R—30 inches; limestone bedrock.

The thickness of the solum and depth to bedrock range from 20 to 40 inches. Fragments of sandstone, limestone, or both, range from 0 to 10 percent throughout the profile. Fragments of sandstone range from 1/2 inch to 3 inches in diameter, and fragments of limestone range from 1/2 inch to 10 inches in diameter. In unlimed areas reaction ranges from very strongly acid to medium acid in the upper part of the solum and from medium acid to neutral in the lower part of the solum.

The A1 horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. Cultivated soils have an Ap horizon that is brown or dark brown and is 5 to 8 inches thick.

Tthe B21t horizon has hue of 5YR, value of 4 or 5, and chroma of 6. It is silty clay or silty clay loam. The B22t horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 4 to 8. Some pedons have few to many mottles of these colors, and some pedons have mottles of pale brown or light brownish gray in the lower part of this horizon. The B22t horizon is silty clay or clay. The B23t horzion has hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It has mottles of these colors. The B23 horizon is silty clay or clay. In some pedons secondary lime concretions are in the lower part of this horizon.

Clifty series

The Clifty series consists of deep, well drained soils that formed in alluvium derived from acid siltstone, sandstone, shale, and loess. These soils are on flood plains near heads of streams. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Clifty soils are geographically associated with Vicksburg, Collins, Belknap, Waverly, and Newark soils on flood plains and Wellston, Frondorf, Lenberg, and Zanesville soils on uplands. All of the associated soils have less gravel in the upper part of the solum than Clifty soils. Collins, Belknap, Waverly, and Newark soils are not so well drained and have a gray subsoil or have gray mottles in the subsoil. Wellston, Frondorf, Lenberg, and Zanesville soils have an argillic horizon.

Typical pedon of Clifty gravelly silt loam, 2 miles west of Rosewood, 300 yards west of Kentucky Highway 181, 100 feet south of Kentucky Highway 890, and 100 feet west of Bat East Creek, in Muhlenberg County:

Ap—0 to 8 inches; brown (10YR 4/3) gravelly silt loam; weak fine granular structure; very friable; many roots; 20 percent sandstone fragments 1/8 inch to 3 inches in diameter; medium acid; clear smooth boundary.

B2—8 to 26 inches; brown (10YR 4/3) gravelly silt loam; weak fine subangular blocky and granular structure; very friable; few roots; 15 percent sandstone fragments 1/8 inch to 3 inches in diameter; strongly acid; gradual smooth boundary.

C—26 to 60 inches; brown (10YR 4/3) gravelly silt loam; massive; very friable; 35 percent sandstone fragments 1/2 inch to 12 inches in diameter increasing to 50 percent below a depth to 40 inches; strongly acid.

The thickness of the solum ranges from 20 to 40 inches. Depth to bedrock is more than 60 inches. Content of pebbles and cobbles ranges from 5 to 40 percent in individual horizons but averages less than 35 percent above a depth of 40 inches. In unlimed areas reaction is strongly acid to very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Texture of the fine earth fraction is silt loam or loam.

The C horizon has colors similar to those in the B horizon and has gray mottles in some pedons. It has weak granular or subangular blocky structure, or it is massive. Texture of the fine-earth fraction ranges from silt loam to sandy clay loam.

Collins series

The Collins series consists of deep, moderately well drained soils that formed in alluvium washed from soils that formed in loess. These soils are mostly in narrow valleys and near the base of slopes on flood plains. Permeability is moderate. Slopes range from 0 to 4 percent.

Collins soils are geographically associated with Clifty, Vicksburg, Belknap, and Waverly soils. Clifty and Vicksburg soils are better drained and are not gray in the upper part of the subsoil. Clifty soils have gravel throughout the profile. Belknap and Waverly soils are more poorly drained and have a higher percentage of gray in the subsoil. Lindside soils are similar in drainage to the Collins soils, but they are less acid and have more clay in the subsoil.

Typical pedon of Collins silt loam, 1 mile west of Sacramento, 1 mile north of State Highway 81, and 100 feet north of bend in the road, in McLean County:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; many roots; strongly acid; clear smooth boundary.

B21—9 to 18 inches; brown (10YR 4/3) silt loam; common medium distinct mottles of pale brown (10YR 6/3); weak medium subangular blocky structure; friable; few roots; very strongly acid; clear smooth boundary.

B22—18 to 32 inches; mottled light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4) silt loam; few fine distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; very strongly acid; clear smooth boundary.

C—32 to 60 inches; mottled light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) silt loam; massive; friable; strongly acid.

The thickness of the solum ranges from 30 to 60 inches or more. Depth to bedrock is more than 60 inches. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 1 to 4. Chroma is mainly 3 or 4 above a depth of 20 inches. In some pedons chroma is mainly 1 to 2 below a depth of 24 inches. The B horizon has subangular blocky or granular structure.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 1 to 4. It has weak subangular blocky or granular structure or it is massive. This horizon is silt loam or loam and is stratified in some pedons.

In this survey area, the Collins soils are taxadjuncts to the series. They have more profile development and less stratification by recent sediment than is described in the range for the series.

Elk series

The Elk series consists of deep, well drained soils that formed in alluvium on stream terraces in the Green River Valley and near streams in the southwestern part of Muhlenberg County. Permeability is moderate. Slopes range from 2 to 12 percent.

Elk soils are geographically associated with Otwell, Weinbach, Nolin, Lindside, Newark, and Melvin soils. Otwell and Weinbach soils have a fragipan. Nolin, Lindside, Newark, and Melvin soils do not have an argillic horizon. Weinbach, Lindside, Newark, and Melvin soils are gray in the subsoil. Memphis and Wellston soils are similar to Elk soils, but they are on uplands and are not underlain by stratified sediment.

Typical pedon of Elk silt loam, 6 to 12 percent slopes, 5 miles northwest of Beech Grove, 1/2 mile west of State Highway 136, 1/2 mile south of Green River, and 100 feet south of gravel road, in McLean County:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; many tree roots; slightly acid; abrupt smooth boundary.

B21t—9 to 26 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate fine subangular blocky structure; friable; thin continuous clay films; few tree roots; very strongly acid; diffuse smooth boundary.

B22t—26 to 36 inches; strong brown (7.5YR 5/6) silty clay loam; few medium distinct pale brown (10YR 6/

3) mottles; moderate fine and medium subangular blocky structure; yellowish brown (10YR 5/6) when crushed; firm; thin continuous clay films; few roots between peds; very strongly acid; gradual smooth boundary.

B23t—36 to 50 inches; yellowish brown (10YR 5/6) light silty clay loam; few fine faint brown (7.5YR 4/4) and common fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; patchy clay films; very strongly acid; gradual smooth boundary.

C—50 to 60 inches; mottled brown (7.5YR 4/4) and grayish brown (10YR 5/2) heavy silt loam; massive; firm; black concretionary stains in cracks; very strongly acid.

The thickness of the solum ranges from 40 to 50 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in some places. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The B23t horizon has mottles that have chroma of 1 to 3. The B horizon is heavy silt loam or light silty clay loam.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. The horizon is mottled in most pedons. It ranges from loam to silty clay loam.

In the survey area, the Elk soils are taxadjuncts to the series. The C horizon is slightly more acid than is described in the range for the series.

Frondorf series

The Frondorf series consists of moderately deep, well drained soils that formed in thin loess and residuum derived from acid sandstone and siltsone. These soils are on hillsides and narrow hilltops and are mostly in Muhlenberg County. Permeability is moderate. Slopes range from 12 to 50 percent.

Frondorf soils are geographically associated with Wellston, Zanesville, Lenberg, and Caneyville soils. Wellston and Zanesville soils are deeper to bedrock, and Zanesville soils have a fragipan. Lenberg and Caneyville soils have more clay in the subsoil. Lenberg soils are underlain by soft shale, and Caneyville soils are underlain by limestone.

Typical pedon of Frondorf silt loam in an area of Frondorf-Lenberg complex, 12 to 20 percent slopes, 1 1/2 miles east of State Highway 181 toward Rosewood and 100 feet south of State Highway 973, in Muhlenberg County:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; many roots; 5 percent sandstone fragments 1/2 to 1 inch in diameter; very strongly acid; clear smooth boundary.

B21t—5 to 20 inches; brown (7.5YR 5/4) silt loam; moderate fine subangular blocky structure; friable; 5 percent sandstone fragments 1 inch to 3 inches in diameter; patchy clay films; very strongly acid; diffuse smooth boundary.

B22t—20 to 32 inches; strong brown (7.5YR 5/6) channery silt loam; weak fine subangular blocky structure; friable; few patchy clay films; 40 percent sandstone fragments 1 inch to 6 inches long; very strongly acid.

R—32 inches; sandstone bedrock.

The thickness of the solum ranges from 20 to 40 inches. Depth to bedrock ranges from 20 to 40 inches. Content of pebbles and cobbles ranges from 0 to 5 percent in the upper part of the solum and from 20 to 50 percent in the lower part of the solum. In unlimed areas, reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Some pedons have a dark brown A1 horizon and a brown or yellowish brown A2 horizon.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The B22t horizon has mottles of pale brown and yellowish brown in some pedons. The B21t horizon is silt loam or light silty clay loam. The fine earth fraction of the B22t horizon ranges from loam to silty clay loam.

Some pedons have a C horizon that is channery or cobbly sandy clay loam or loam 4 to 6 inches thick.

Grenada series

The Grenada series consists of deep, moderately well drained soils that formed in loess on uplands and terraces. These soils have a fragipan. Permeability is moderate above the fragipan and is slow in the fragipan. Slopes range from 0 to 6 percent.

Grenada soils are geographically associated with Calloway, Loring, Zanesville, Wellston, and Memphis soils. Calloway soils are not so well drained and are gray in the upper part of the subsoil. Loring and Zanesville soils are not bisequal. Zanesville and Wellston soils formed in thin loess and the underlying residuum and are not so deep to bedrock. Wellston and Memphis soils do not have a fragipan. Sadler soils are similar to Grenada soils except they formed in a thin mantle of loess and the underlying residuum and are not so deep to bedrock.

Typical pedon of Grenada silt loam, 2 to 6 percent slopes, 1 mile northeast of Sacramento, 1/2 mile north of State Highway 81, and 200 feet west of paved road, in McLean County:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; very friable; many roots; strongly acid; clear smooth boundary.

B2t—8 to 24 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; patchy clay films of strong brown (7.5YR

5/6); many roots; few pores and worm channels; very strongly acid; gradual wavy boundary.

A'2 and B—24 to 28 inches; very pale brown (10YR 7/3) silt loam; weak fine subangular blocky structure; very friable; about 30 percent strong brown (7.5YR 5/6) heavy silt loam firm peds of B horizon imbedded in the matrix; very strongly acid; clear wavy boundary.

B'x1—28 to 43 inches; mottled brown (7.5YR 4/4), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6) light silty clay loam; moderate coarse prismatic and moderate medium subangular blocky structure; very firm, brittle, and compact; light gray (10YR 7/1) silt coatings 2 to 10 millimeters thick on prisms and in cracks; patchy clay films on blocky ped surfaces; strongly acid; gradual wavy boundary.

B'x2—43 to 60 inches; mottled dark yellowish brown (10YR 4/4) and brown (10YR 5/3) silt loam; weak very coarse prismatic structure parting to weak medium subangular blocky; firm, compact, and brittle; grayish brown (10YR 5/2) clay films between some prisms; black stains in some pores; medium acid.

The thickness of the solum ranges from 36 to 70 inches. Depth to bedrock is more than 60 inches. The thickness of loess is more than 48 inches. Depth to the fragipan ranges from 18 to 30 inches. In unlimed areas, reaction is medium acid to very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. Some pedons have mottles of pale brown or light brownish gray below a depth of 20 inches. This horizon is heavy silt loam or light silty clay loam.

The A'2 horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. In most pedons this horizon is 2 to 4 inches thick, tongues into the underlying horizon, and includes imbedded pieces of B horizon material.

The B'x horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. It is mottled in shades of gray and brown. The light gray coatings in cracks are silty clay loam or silt loam, and in most pedons the clay content of the coatings increases with depth.

Henshaw series

The Henshaw series consists of deep, somewhat poorly drained soils that formed in alluvium from loess. These soils are on stream terraces mostly in areas of old alluvium near the Green River and its major tributaries. Permeability is moderately slow. Slopes range from 0 to 4 percent but are mostly 0 to 2 percent.

Henshaw soils are geographically associated with Markland and McGary soils on stream terraces and Newark, Melvin, Belknap, Waverly, and Karnak soils on flood plains. Markland and McGary soils have more clay in the subsoil. Markland soils are better drained and have a lower percentage of gray in the upper part of the subsoil. Newark, Melvin, Belknap, Waverly, and Karnak soils do not have an argillic horizon. Melvin, Waverly, and Karnak soils have a higher percentage of gray in the subsoil. Belknap and Waverly soils have less clay in the subsoil, and Karnak soils have more clay.

Typical pedon of Henshaw silt loam, 2 miles south of Rumsey, 200 feet east of Kentucky Highway 81, and 200 feet north of Cypress Creek, in McLean County:

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; few roots; few pieces of corn stalks; slightly acid; abrupt smooth boundary.

B21t—8 to 14 inches; yellowish brown (10YR 5/6) heavy silt loam; many moderate distinct light gray (10YR 7/1) and light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; firm; few roots; strongly acid; gradual smooth boundary.

B22t—14 to 24 inches; yellowish brown (10YR 5/4) heavy silt loam; common moderate distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; firm; few roots; strongly acid; gradual smooth boundary.

B23t—24 to 36 inches; brown (10YR 5/3) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; firm; gray clay in vertical cracks and on prisms; medium acid; gradual smooth boundary.

B3t—36 to 48 inches; strong brown (7.5YR 5/6) light silty clay loam; many moderate distinct light gray (10YR 7/1) mottles; moderate medium subangular blocky structure; friable; few small black concretions; mildly alkaline; gradual smooth boundary.

C—48 to 60 inches; mottled strong brown (7.5YR 5/6) and light gray (10YR 7/2) heavy silt loam; massive; friable; many brown concretionary stains; moderately alkaline.

The thickness of the solum ranges from 40 to 50 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. In unlimed areas, reaction is strongly acid or medium acid to a depth of about 30 inches and is slightly acid to moderately alkaline below that.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B horizon mainly has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. Mottles have hue of 10YR or 2.5Y, value of 6 or 7, and chroma of 1 or 2. In some pedons colors that have low chroma are dominant in the lower part. The B horizon is heavy silt loam or silty clay loam.

The C horizon is mottled in the same colors as the B horizon. It is silt loam or light silty clay loam. In some pedons the C horizon is calcareous.

Karnak series

The Karnak series consists of deep, poorly drained soils that formed in slack water alluvium in flood plains of the Green River and Pond River in McLean County and in the northern part of Muhlenberg County. Permeability is slow. Slopes range from 0 to 2 percent.

Karnak soils are geographically associated with Markland, McGary, and Henshaw soils on stream terraces and Newark and Melvin soils on flood plains. Markland, McGary, and Henshaw soils have an argillic horizon, and they are better drained and have a lower percentage of gray in the subsoil. Newark and Melvin soils contain less clay, and Newark soils are better drained and have a lower percentage of gray in the subsoil.

Typical pedon of Karnak silty clay, 2 miles north of Millport, 1/2 mile west of State Highway 423, 200 feet east of woods, and 400 feet north of ditch, in Muhlenberg County:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; friable; many fine roots; strongly acid; gradual smooth boundary.

B1g—8 to 11 inches; mottled dark grayish brown (10YR 4/2) and gray (10YR 5/1) silty clay; weak fine subangular blocky structure; very firm; many fine roots; medium acid; clear smooth boundary.

B2g—11 to 29 inches; gray (10YR 5/1) clay; many fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium angular blocky structure; very firm; slightly acid; gradual smooth boundary.

B3g—29 to 60 inches; mottled gray (10YR 5/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) clay; weak fine subangular blocky structure; very firm; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches or more. Depth to bedrock is more than 60 inches and is as much as 100 feet in a few places. Reaction ranges from strongly acid to slightly acid in the upper part of the profile and from slightly acid to mildly alkaline in the lower part.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The structure is weak or moderate, granular or subangular blocky. In some pedons the A horizon consists of 7 to 15 inches of silt loam overwash.

The B horizon mainly has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottles have hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 8. This horizon is clay or silty clay.

Lenberg series

The Lenberg series consists of moderately deep, well drained soils that formed in acid, clayey shale, which in some places is interbedded with sandstone and siltstone. These soils are on hillsides mostly in the southern part of Muhlenberg County. Permeability is moderately slow. Slopes range from 12 to 30 percent.

Lenberg soils are geographically associated with Frondorf, Wellston, Zanesville, and Caneyville soils. Frondorf, Wellston, and Zanesville soils have less clay in the subsoil; Wellston and Zanesville soils are deeper to bedrock; and Zanesville soils have a fragipan. Caneyville soils are underlain by limestone bedrock.

Typical pedon of Lenberg silt loam, in an area of Frondorf-Lenberg complex, 12 to 20 percent slopes, 6 miles southeast of Greenville, 200 feet north of State Highway 1163, and 1,000 feet east of old school, in Muhlenberg County:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; very friable; many tree roots; some partly decayed leaves; 10 percent sandstone fragments 1/4 to 1 inch in diameter and 5 percent sandstone fragments 2 to 5 inches in diameter; strongly acid; abrupt smooth boundary.

A2—2 to 4 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; many tree roots; 10 percent sandstone fragments 1/4 to 1 inch in diameter; very strongly acid; clear smooth boundary.

B21t—4 to 18 inches; strong brown (7.5YR 5/6) heavy silty clay loam; moderate fine subangular blocky structure; firm; many tree roots; continuous clay films on peds; 5 percent sandstone fragments 1/4 to 1 inch in diameter; very strongly acid; gradual smooth boundary.

B22t—18 to 25 inches; strong brown (7.5YR 5/6) silty clay; many fine distinct light yellowish brown (10YR 6/4) and common medium distinct light gray (10YR 7/2) mottles; moderate fine and medium angular blocky structure; firm; few roots; continuous clay films on peds; 10 percent sandstone and siltstone fragment 1/2 inch to 2 inches in diameter; few sandstone pieces 6 to 12 inches in diameter; very strongly acid; gradual wavy boundary.

C—25 to 35 inches; mottled light olive brown (2.5Y 5/4) and light gray (2.5Y 7/1) very gravelly silty clay; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky relic shale structure; firm; 50 percent sandstone and siltstone fragments 1/2 inch to 3 inches in diameter; very strongly acid; gradual smooth boundary.

Cr—35 to 45 inches; light gray (2.5Y 7/2) acid soft shale.

The thickness of the solum is 20 to 40 inches. Depth to bedrock of soft shale ranges from 20 to 40 inches. Content of pebbles and cobbles ranges from 5 to 15 percent in the solum and from 5 to 50 percent in the C horizon. In unlimed areas reaction ranges from very strongly acid to strongly acid throughout.

The A1 horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Cultivated soils have an

Ap horizon that has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

The B horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. Mottles in the lower part of this horizon have hue of 10YR or 2.5Y, value of 6 or 7, and chroma of 1 or 2. The B horizon ranges from heavy silty clay loam to clay.

The C horizon is mottled in shades of gray and brown. Most gray colors have hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2. Brown colors have hue of 2.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. The fine earth fraction is silty clay or clay. Some pedons do not have a C horizon, and the B horizon rests on a paralithic contact of soft shale.

Lindside series

The Lindside series consists of deep, moderately well drained soils that formed in alluvium derived from limestone, sandstone, siltstone, shale and loess. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Lindside soils are geographically associated with Nolin, Newark, and Melvin soils on flood plains and Elk, Otwell, and Weinbach soils on stream terrraces. Nolin soils are better drained and are not gray in the upper part of the subsoil. Newark and Melvin soils are more poorly drained and have a higher percentage of gray in the subsoil. Elk, Otwell, and Weinbach soils have an argillic horizon. Elk soils are better drained and are not gray in the subsoil. Otwell and Weinbach soils have a fragipan.

Typical pedon of Lindside silt loam, 1 mile southwest of Calhoun, 1,000 feet north of the Green River, and 100 feet west of ditch, in McLean County:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; few wormholes, roots and stems; slightly acid; clear smooth boundary.

B21—9 to 18 inches; brown (10YR 4/3) heavy silt loam; weak medium subangular blocky structure; friable; few wormholes; slightly acid; gradual smooth boundary.

B22—18 to 40 inches; brown (10YR 4/3) silt loam; common medium distinct grayish brown (10YR 5/1) and yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; few brown concretions; medium acid; diffuse smooth boundary.

Cg—40 to 60 inches; grayish brown (10YR 5/2) silt loam; common medium distinct brown (10YR 4/3) mottles; weak fine granular structure; friable; few brown concretions; medium acid.

The thickness of the solum ranges from 35 to 50 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Reaction ranges from medium acid to slightly acid throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The upper part of the B horizon mainly has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. Mottles have hue of 10YR, value of 5 to 7, and chroma of 1 or 2. In some pedons these colors are mainly below a depth of 24 inches. The B horizon has granular or subangular blocky structure and ranges from light silty clay loam to very fine sandy loam.

The Cg horizon has color similar to the B horizon. It has mainly low chroma or is equally mottled in gray and brown. It has granular or subangular blocky structure, or it is massive. This horizon is stratified in some pedons.

Loring series

The Loring series consists of deep, moderately well drained soils that formed in loess on ridgetops and side slopes and that have a fragipan. Permeability is moderate. Slopes range from 2 to 20 percent.

Loring soils are geographically associated with Grenada, Calloway, Wellston, Memphis, and Zanesville soils. Grenada and Calloway soils are bisequal, and Calloway soils are more poorly drained and are gray in the upper part of the subsoil. Wellston and Memphis soils do not have a fragipan, and Wellston soils are not so deep to bedrock. Zanesville soils formed in thin loess and underlying residuum and are not so deep to bedrock.

Typical pedon of Loring silt loam, 2 to 6 percent slopes, 1/2 mile south of Millport, and 300 feet south of junction of State Highways 423 and 175, in Muhlenberg County:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; few worm casts; slightly acid; clear smooth boundary.

B21t—7 to 21 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate very fine and fine, subangular blocky structure; firm; many fine roots; thin discontinuous clay films; very strongly acid; clear smooth boundary.

B22t—21 to 27 inches; strong brown (7.5YR 5/6) light silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; many fine root channels; thin continuous clay films; very strongly acid; clear smooth boundary.

B23t—27 to 33 inches; yellowish brown (10YR 5/6) silt loam; few fine faint pale brown (10YR 6/3) and brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; firm; few roots; few pores; few worm channels; thin discontinuous clay films; very strongly acid; gradual wavy boundary.

Bx1—33 to 43 inches; brown (7.5YR 4/4) light silty clay loam; common fine distinct strong brown (7.5YR 5/6) and light gray (10YR 7/2) mottles; moderate coarse prismatic structure parting to moderate fine and medium angular blocky; very firm, compact, and brittle; few roots; thin continuous clay films on peds and in pores; few small soft black concretions; very strongly acid; gradual smooth boundary.

Bx2—43 to 50 inches; brown (7.5YR 4/4) silt loam; common fine distinct light gray (10YR 7/2) mottles; moderate coarse prismatic structure parting to weak coarse subangular blocky; very firm, compact, and brittle; thin discontinuous clay films on ped faces and in pores; few small soft black concretions; very strongly acid; gradual smooth boundary.

C—50 to 64 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct yellowish brown (10YR 5/6), light gray (10YR 7/2), and pale brown (10YR 6/3) mottles; massive; very firm; thin clay films; small root channels; few to many small soft black concretions; very strongly acid.

The thickness of the solum ranges from 45 to 70 inches. Depth to bedrock is more than 60 inches. Thickness of the loess is more than 48 inches. Depth to the fragipan ranges from 24 to 35 inches unless the soil is severely eroded. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. In some pedons the B23t horizon has mottles that have chroma of 2 or 3. Texture is heavy silt loam or light silty clay loam.

The Bx horizon mainly has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Mottles have hue of 10YR, value of 5 to 7, and chroma of 1 to 3.

Markland series

The Markland series consists of deep, well drained to moderately well drained soils that formed in slack water sediment on stream terraces near the Green River and its major tributaries. Permeability is slow. Slopes range from 12 to 35 percent.

Markland soils are geographically associated with McGary and Henshaw soils on stream terraces and Karnak soils on flood plains. McGary and Henshaw soils are more poorly drained and have higher percentage of gray in the subsoil, and Henshaw soils have less clay in the subsoil. Karnak soils do not have an argillic horizon, are more poorly drained, and have a higher percentage of gray in the subsoil.

Typical pedon of Markland silt loam, 12 to 35 percent slopes, 3 miles southeast of Beech Grove and 1/2 mile northeast of the Green River, in McLean County:

A1—0 to 1 inch; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; very friable; few roots; some partly decayed oak leaves; medium acid; abrupt smooth boundary.

A2—1 inch to 3 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; few tree roots; strongly acid; clear smooth boundary.

B21t—3 to 15 inches; yellowish brown (10YR 5/4) silty clay; moderate very fine angular blocky structure; very firm; brown (10YR 4/3) clay films on ped surfaces; few tree roots; strongly acid; diffuse smooth boundary.

B22t—15 to 30 inches; yellowish brown (10YR 5/4) clay; few fine distinct gray (10YR 6/1) mottles; strong fine angular blocky structure; very firm; few roots; thin continuous clay films; slightly acid; gradual smooth boundary.

B3—30 to 42 inches; mottled dark grayish brown (2.5Y 4/2), brown (10YR 5/3), and gray (10YR 6/1) silty clay; moderate fine angular blocky structure; very firm; soft lime deposits; moderately alkaline; calcareous; gradual wavy boundary.

C—42 to 60 inches; grayish brown (2.5Y 5/2) clay; many coarse distinct strong brown (7.5YR 5/6) mottles; massive; very firm; moderately alkaline; calcareous.

The thickness of the solum ranges from 30 to 44 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. In unlimed areas reaction is medium acid to strongly acid in the upper part of the solum and slightly acid to moderately alkaline in the lower part.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 5, and chroma of 2 or 3. Soils that have been cultivated have an Ap horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Texture is silt loam, silty clay loam, or silty clay.

The B horizon mainly has hue of 10YR or 2.5Y and value of 4 or 5. Mottles in the B22t and B3 horizons have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. Texture is silty clay or clay, except it is heavy silty clay loam in the upper part of the B horizon of some pedons.

The C horizon has hue of 10YR and 2.5Y, value of 4 to 7, and chroma of 1 to 6. It is mottled in shades of gray and brown. This horizon is silty clay or clay. It has lime concretions in some pedons.

McGary series

The McGary series consists of deep, somewhat poorly drained soils that formed in clayey slack water alluvium on low stream terraces along the Green River and its major tributaries. Permeability is slow. Slopes are mostly less than 2 percent but range to as much as 5 percent.

McGary soils are geographically associated with Karnak, Henshaw, and Markland soils. Karnak soils do not have an argillic horizon, are more poorly drained, and have a higher percentage of gray in the subsoil. Henshaw soils have less clay in the subsoil. Markland soils are better drained and have a lower percentage of gray in the subsoil.

Typical pedon of McGary silt loam, 4 miles west of Calhoun, 400 feet south of State Highway 256, and 200 feet southwest of house, in McLean County:

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; few roots; neutral; abrupt smooth boundary.

B21t—8 to 24 inches; light brownish gray (2.5Y 6/2) silty clay; many fine distinct yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure; firm; few roots; few brown concretions; clay films on ped surfaces; strongly acid; diffuse smooth boundary.

B22t—24 to 45 inches; mottled light olive brown (2.5Y 5/4), grayish brown (2.5Y 5/2), and yellowish brown (10YR 5/6) silty clay; moderate fine angular blocky structure; firm; grayish brown clay films on ped surfaces; medium acid; gradual smooth boundary.

C—45 to 66 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) silty clay; weak fine angular blocky structure; very firm; many black concretionary stains in the upper part; few soft lime concretions in the lower part; mildly alkaline.

The thickness of the solum ranges from 30 to 55 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. In unlimed areas reaction ranges from strongly acid to medium acid in the upper part of the solum and from medium acid to mildly alkaline in the lower part.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. Soils in wooded areas have an A1 horizon that has hue of 10YR, value of 3 or 4, and chroma of 1 or 2 and an A2 horizon that has hue of 10YR, value of 5, and chroma of 1 to 3.

The B horizon is mottled in shades of gray and brown. Gray colors have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. Brown colors have hue of 10YR or 2.5Y, value of 5, and chroma of 4 to 6. The B horizon is silty clay or heavy silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 and 6, and chroma of 1 to 6. It is mottled in shades of gray and brown. This horizon ranges from silty clay loam to clay and has lime concretions in some pedons.

Melvin series

The Melvin series consists of deep, poorly drained soils that formed in alluvium that washed from soils formed in residuum derived from mixed parent materials. These soils are on flood plains in the Green River Valley and in the southwestern part of Muhlenberg County. Permeability is moderate. Slopes range from 0 to 3 percent but are mainly less than 2 percent.

Melvin soils are geographically associated with Nolin, Lindside, Newark, and Karnak soils. Nolin, Lindside, and Newark soils are better drained and have a lower percentage of gray in the subsoil. Karnak soils have more clay.

Typical pedon of Melvin silt loam, 2 miles west of Livermore, 1/2 mile west of Richland Church, and 1/2 mile north of Green River, in trench cut for a pipeline, in McLean County:

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; very friable; few roots; medium acid; clear smooth boundary.

B21g—8 to 24 inches; gray (10YR 5/1) heavy silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots and brown concretionary stains; medium acid; diffuse smooth boundary.

B22g—24 to 36 inches; gray (5Y 6/1) heavy silt loam; many medium distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; firm; slightly acid; diffuse smooth boundary.

Cg—36 to 60 inches; gray (5Y 6/1) light silty clay loam; common medium distinct yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Reaction ranges from medium acid to mildly alkaline throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The B and C horizons mainly have hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. Mottles have hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 4 to 6. These horizons have weak or moderate and fine or medium subangular blocky structure. They are light silty clay loam or heavy silt loam.

Memphis series

The Memphis series consists of deep, well drained soils that formed in loess on side slopes and ridgetops mostly in the northern part of McLean County. Permeability is moderate. Slopes range from 2 to 12 percent.

Memphis soils are geographically associated with Loring, Grenada, and Wellston soils. Loring and Grenada soils have a fragipan. Wellston soils are not so deep to bedrock. Elk soils are similar to Memphis soils, except they are on stream terraces and are underlain by stratified sediment.

Typical pedon of Memphis silt loam, 2 to 6 percent slopes, 1 mile west of Elba, 1/4 mile south of Kentucky Highway 593, and 50 feet east of private road, in McLean County:

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; few roots; few pieces of undecayed organic matter; medium acid; abrupt smooth boundary.

B21t—8 to 20 inches; brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; continuous clay films; few roots; few black concretionary stains on ped surfaces; strongly acid; diffuse smooth boundary.

B22t—20 to 36 inches; strong brown (7.5YR 5/6) light silty clay loam; moderate medium subangular blocky structure; friable; brown (7.5YR 4/4) clay films; few roots; few black concretionary stains on ped surfaces; strongly acid; gradual smooth boundary.

C—36 to 60 inches; strong brown (7.5YR 5/6) silt loam; few moderate faint pale brown (10YR 6/3) mottles; pale brown silt in cracks; massive; friable; strongly acid.

The thickness of the solum ranges from 32 to 42 inches. Depth to bedrock is more than 60 inches. Thickness of loess is more than 48 inches. In unlimed areas reaction ranges from medium acid to very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It has weak or moderate and medium or fine structure. This horizon is heavy silt loam or silty clay loam.

The C horizon mainly has hue of 7.5YR or 10YR, value of 5, and chroma of 6 to 8. Mottles have hue of 10YR, value of 5 or 6, and chroma of 1 to 3.

Newark series

The Newark series consists of deep, somewhat poorly drained soils that formed on bottoms in alluvium derived from limestone, sandstone, siltstone, shale, and loess. Permeability is moderate. Slopes range from 0 to 4 percent but are mainly less than 2 percent.

Newark soils are geographically associated with Nolin, Lindside, and Melvin soils on flood plains and Elk, Otwell, and Weinbach soils on stream terraces. Nolin and Lindside soils are better drained and have a lower percentage of gray mottles in the subsoil. Melvin soils are more poorly drained and have a higher percentage of gray mottles in the subsoil. Elk, Otwell, and Weinbach soils have an argillic horizon. Elk and Otwell soils are better drained and have a lower percentage of gray mottles in the subsoil. Otwell and Weinbach soils have a fragipan.

Typical pedon of Newark silt loam, 8 miles south of Greenville, 1 mile east of the Pond River, and 300 feet northwest of Pond Creek, in Muhlenberg County:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few roots; neutral; clear smooth boundary.

B21—8 to 18 inches; brown (10YR 4/3) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak fine granular structure; very friable; few roots; few worm casts; visible pores; few brown concretions; medium acid; gradual smooth boundary.

B22g—18 to 40 inches; light gray (10YR 7/2) silt loam; common medium distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak fine granular structure; very friable; medium acid; gradual smooth boundary.

Cg—40 to 60 inches; light gray (10YR 7/2) heavy silt loam; common medium distinct dark brown (10YR 4/3) and yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; medium acid.

The thickness of the solum ranges from 25 to 44 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Reaction ranges from medium acid to neutral throughout.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4.

The B horizon is mottled in shades of gray and brown. The B21 horizon has mainly hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles have hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. The Bg horizon has similar colors except that chroma of 1 or 2 is dominant. Depth to gleyed horizons ranges from 10 to 20 inches. The B horizon has granular or subangular blocky structure. It is silt loam or light silty clay loam.

The Cg horizon has colors and texture similar to the Bg horizon.

Nolin series

The Nolin series consists of deep, well drained soils that formed in alluvium derived from limestone, sandstone, siltstone, shale, and loess. These soils are on flood plains mostly near the Green River, Mud River, or Pond River or in the southwestern part of Muhlenberg County. Permeability is moderate. Slopes are mostly less than 2 percent but range to as much as 30 percent on the sides of sloughs and the banks of rivers.

Nolin soils are geographically associated with Lindside, Newark, and Melvin soils on flood plains and Elk, Otwell, and Weinbach soils on stream terraces. All of these soils except the Elk soils are not so well drained and have a higher percentage of gray mottles in the subsoil. Elk, Otwell, and Weinbach soils have an argillic horizon, and Otwell and Weinbach soils have a fragipan. Vicksburg and Clifty soils are similar to Nolin soils, except they are more acid and have less clay in the subsoil, and Clifty soils have more gravel.

Typical pedon of Nolin silt loam, 1 1/4 miles west of State Highway 171, 1/4 mile east of Johnson Bridge, west side of Caney Creek, and 25 feet south of junction of Caney Creek and Pond River, in Muhlenberg County:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; weak medium granular structure; friable; neutral; abrupt smooth boundary.

B21—10 to 30 inches; brown (10YR 4/3) heavy silt loam; weak medium granular structure; friable; slightly acid; gradual wavy boundary.

B22—30 to 45 inches; brown (7.5YR 5/4) heavy silt loam; few fine faint light yellowish brown (10YR 6/4) and dark yellowish brown (10YR 3/4) mottles; weak

medium granular structure; friable; many roots, pores, and worm casts; slightly acid; gradual smooth boundary.

C—45 to 65 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct pale brown (10YR 6/3) and light brownish gray (10YR 6/2) mottles; massive; friable; few fine roots; few brown concretions; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Reaction ranges from medium acid to neutral throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. In some pedons it is mottled below a depth of 24 inches in hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The B horizon is silt loam or light silty clay loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6, and it is mottled in some pedons. It has weak granular or subangular blocky structure or is massive.

Otwell series

The Otwell series consists of deep, moderately well drained soils that formed in alluvium on stream terraces in the Green River Valley in both counties and near smaller streams in the southwestern part of Muhlenberg County. These soils have a fragipan. Permeability is moderate above the fragipan and is slow in the fragipan. Slopes range from 0 to 6 percent.

Otwell soils are geographically associated with Elk and Weinbach soils on stream terraces and Nolin, Lindside, Newark, and Melvin soils on flood plains. Elk soils do not have a fragipan. Weinbach soils are more poorly drained and have a higher percentage of gray in the subsoil. Nolin, Lindside, Newark, and Melvin soils do not have an argillic horizon or a fragipan, and Lindside, Newark, and Melvin soils have a higher percentage of gray in the subsoil. Grenada, Loring, and Sadler soils are similar in drainage but are on uplands and are not underlain by stratified sediment.

Typical pedon of Otwell silt loam, 2 to 6 percent slopes, 4 miles west of Beech Grove, 2 miles southwest of Rangers Landing, 1 mile east of Green River, and 1/4 mile east of gravel road, in McLean County:

Ap—0 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; few roots and wormholes; very strongly acid; clear smooth boundary.

B21t—10 to 16 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate fine subangular blocky structure; friable; few roots; clay films; few wormholes; very strongly acid; gradual smooth boundary.

B22t—16 to 27 inches; yellowish brown (10YR 5/6) heavy silt loam; common medium faint pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; few roots; clay films; very strongly acid; clear wavy boundary.

Bx—27 to 45 inches; brown (7.5YR 4/4) light silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to strong medium and coarse angular blocky; firm, brittle, and compact; gray clay in cracks; very strongly acid; gradual smooth boundary.

C—45 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; light brownish gray (10YR 6/2) streaks 15 millimeters wide; massive; firm; very strongly acid.

The thickness of the solum ranges from 40 to 65 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Depth to the fragipan ranges from 18 to 36 inches. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The lower part of the B22t horizon has a few gray mottles in a few pedons. Texture is heavy silt loam or light silty clay loam.

The Bx horizon has hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 2 to 6 and is mottled in shades of gray and brown. It is silt loam or light silty clay loam.

The C horizon has mainly hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 3 or 4 and is faintly mottled in shades of gray. It is silt loam or silty clay loam.

Sadler series

The Sadler series consists of deep, moderately well drained soils that formed in thin loess and residuum from sandstone and siltstone on ridgetops and toe slopes mostly in Muhlenberg County. These soils have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes are mostly 0 to 6 percent.

Sadler soils are geographically associated with Zanesville, Wellston, Frondorf, Lenberg, and Calloway soils. Zanesville soils are not bisequal. Wellston, Frondorf, and Lenberg soils do not have fragipan. Frondorf and Lenberg soils are not so deep to bedrock, and Lenberg soils have more clay in the subsoil. Calloway soils are not so well drained and have a higher percentage of gray in the subsoil.

Typical pedon of Sadler silt loam, 2 to 6 percent slopes, 1 1/2 miles south of Myers Chapel Church and 50 feet west of State Highway 973, in Muhlenberg County:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; slightly acid; clear smooth boundary.

B2t—7 to 22 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate fine subangular blocky structure;

friable; many roots; few patchy clay films; few pieces of sandstone 5 millimeters in diameter; very strongly acid; clear smooth boundary.

A'2&B—22 to 25 inches; 70 percent A'2 material that is pale brown (10YR 6/3) silt loam; weak fine and medium subangular blocky structure; friable; 30 percent B material that is brown (7.5YR 4/4) and strong brown (7.5YR 5/6) silt loam; moderate fine subangular blocky peds that are coated with A'2 material; very strongly acid; clear wavy boundary.

B'x—25 to 45 inches; mottled yellowish brown (10YR 5/6), brown (7.5YR 4/4), and light brownish gray (10YR 6/2) silt loam; moderate very coarse prismatic structure parting to moderate fine subangular blocky; very firm, brittle, and compact; light brownish gray silt coatings on prisms; brown patchy clay films on blocky peds; very strongly acid; gradual wavy boundary.

C—45 to 60 inches; mottled strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) light silty clay loam; weak medium subangular blocky structure; firm and compact; gray clay in cracks; very strongly acid.

R—60 inches; sandstone bedrock.

The thickness of the solum ranges from 40 to 60 inches. Depth to bedrock ranges from 50 to 80 inches. Depth to the fragipan ranges from 20 to 32 inches. Thickness of the loess mantle ranges from 30 to 48 inches. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. Hue of 7.5YR, when present, is in the upper part. This horizon is silt loam or light silty clay loam. It has weak or moderate and fine or medium structure.

The A'2 part of the A'2&B horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The B part has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6, and makes up 30 to 45 percent of the horizon.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 1 to 6. It is mottled in shades of brown and gray. The lower part ranges from silty clay loam to loam.

The C horizon has colors similar to those in the Bx horizon. It is massive or has subangular blocky structure. It ranges from silty clay to fine sandy loam or their gravelly or channery analogs.

Vicksburg series

The Vicksburg series consists of deep, well drained soils that formed in alluvium that has a high content of silt on flood plains in narrow valleys or near large streams. These soils are subject to flooding. Permeability is moderate. Slopes are mostly less than 2 percent but range to as much as 3 percent.

Vicksburg soils are geographically associated with Clifty, Collins, Belknap, and Waverly soils on flood plains and Wellston and Frondorf soils on uplands. Clifty soils contain more gravel. Collins, Belknap, and Waverly soils are not so well drained and have a higher percentage of gray in the subsoil. Wellston and Frondorf soils have an argillic horizon.

Typical pedon of Vicksburg silt loam, 4 miles southeast of Greenville, 3/4 mile south of State Highway 1163, and 100 feet west of gravel road, in Muhlenberg County:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; few worm casts; medium acid; clear smooth boundary.

B2—8 to 30 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; very friable; few roots; few worm casts; few wormholes; very strongly acid; gradual smooth boundary.

C—30 to 60 inches; brown (10YR 4/3) silt loam; few fine faint pale brown (10YR 6/3) and few coarse distinct light gray (10YR 7/2) mottles; weak fine subangular blocky structure; very friable; few roots; very strongly acid.

The thickness of the solum ranges from 28 to 50 inches. Depth to bedrock is more than 60 inches. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. Some pedons have few to many gray mottles below a depth of 24 inches. The B horizon has granular or subangular blocky structure.

The C horizon mainly has hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 3 or 4. Mottles have hue of 2.5Y to 7.5YR, value of 4 to 7, and chroma of 1 or 2. The C horizon is silt loam or loam and is stratified in some pedons.

In this survey area, the Vicksburg soils are a taxadjunct to the series because they have less stratification than is described in the range for the series.

Waverly series

The Waverly series consists of deep, poorly drained soils that formed in recent alluvium on flood plains in valleys adjacent to uplands throughout the survey area. These soils have a seasonal high water table and are subject to flooding. Permeability is moderate. Slopes are mostly less than 2 percent.

Waverly soils are geographically associated with Vicksburg, Collins, Belknap, Melvin, and Karnak soils. Vicksburg, Collins, and Belknap soils are better drained and have a lower percentage of gray in the subsoil. Melvin and Karnak soils are similar in drainage to Waverly soils but are less acid and have more clay in the subsoil.

Typical pedon of Waverly silt loam, 4 1/2 miles south of Greenville, 800 yards south of Pond Creek, and 80 yards west of State Highway 181, in Muhlenberg County:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; few brown concretions; slightly acid; clear smooth boundary.

Bg—10 to 30 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4) and few medium faint gray (10YR 6/1) mottles; weak fine granular structure; very friable; many brown concretions; few roots; few pores and worm channels; very strongly acid; diffuse smooth boundary.

Cg—30 to 60 inches; light gray (10YR 7/1) silt loam; common fine faint pale brown (10YR 6/3) and common medium distinct dark brown (10YR 3/3) mottles; massive; very friable; many brown concretions; very strongly acid.

The thickness of the solum ranges from 27 to 50 inches. Depth to bedrock is more than 60 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3.

The B horizon mainly has hue of 10YR and 2.5Y, value of 4 to 7, and chroma of 1 or 2. There are few to many mottles that have hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 3 to 6. The B horizon has medium or coarse subangular blocky or fine granular structure.

The C horizon mainly has hue of 10YR and 2.5Y, value of 4 to 7, and chroma of 1 or 2. Mottles have hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 3 to 6. In some pedons the C horizon has weak granular or subangular blocky structure, or it is massive.

Weinbach series

The Weinbach series consists of deep, somewhat poorly drained soils that formed in alluvium on stream terraces mostly in the Green River Valley. These soils have a fragipan. Permeability is slow. Slopes are mostly less than 2 percent but range to 4 percent.

Weinbach soils are geographically associated with Elk and Otwell soils on stream terraces and Nolin, Lindside, Newark, and Melvin soils on flood plains. Elk and Otwell soils are better drained and are not gray in the upper part of the subsoil, and Elk soils do not have a fragipan. Nolin, Lindside, Newark, and Melvin soils do not have an argillic horizon or a fragipan.

Typical pedon of Weinbach silt loam, 3 miles west of Livermore, 1/4 mile south of the Green River, and 50 feet south of State Highway 138, in McLean County:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; many roots; slightly acid; clear smooth boundary.

B2—8 to 26 inches; mottled gray (10YR 6/1), pale brown (10YR 6/3), and yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; many pores; many roots; very strongly acid; clear wavy boundary.

Bx1—26 to 38 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium and fine angular blocky; very firm, brittle, and compact; thin light gray silt coatings on tops of some prisms; grayish brown (10YR 5/2) clay on prisms and blocky peds; few roots between prisms; very strongly acid; gradual wavy boundary.

Bx2—38 to 56 inches; mottled yellowish brown (10YR 5/6) and light gray (10YR 7/1) silt loam; moderate very coarse prismatic structure; very firm, brittle, and compact; grayish brown (10YR 5/2) clay on prisms; very strongly acid; gradual wavy boundary.

C—56 to 70 inches; mottled yellowish brown (10YR 5/6) and light gray (10YR 7/2) silt loam; massive; firm; many black stains in cracks; strongly acid.

The thickness of the solum ranges from 36 to 60 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Depth to the fragipan ranges from 16 to 30 inches. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The B2 horizon has mainly hue of 10YR, value of 5 or 6, and chroma of 3 to 6. Mottles have hue of 10YR, value of 5 to 7, and chroma of 1 or 2, or the horizon is equally mottled with gray and brown. This horizon is silt loam or light silty clay loam. It has weak or moderate and fine or medium structure.

The Bx horizon is mottled in hue of 7.5YR and 10YR, value of 4 and 5, and chroma of 4 to 6 and hue of 10YR and 2.5YR, value of 5 to 7, and chroma of 1 and 2. It is silt loam or silty clay loam. Consistence is firm or very firm.

The C horizon has hue of 7.5YR to 2.5YR, value of 4 to 7, and chroma of 1 to 6. It is mottled in shades of gray and brown. Some pedons have brown or black concretions or concretionary stains.

In this survey area, the Weinbach soils are a taxadjunct to the series because they have horizons above the fragipan that are thicker and have higher chroma than is described in the range for the series.

Wellston series

The Wellston series consists of deep, well drained soils that formed in shallow loess and the underlying residuum from capped sandstone and shale residuum on side slopes and hilltops. Permeability is moderate. Slopes range from 2 to 30 percent.

Wellston soils are geographically associated with Frondorf, Lenberg, Memphis, Sadler, Loring, Grenada, Zanes-

ville, and Calloway soils. Frondorf and Lenberg soils are not so deep to bedrock, Lenberg soils have more clay in the subsoil, and Memphis soils are deeper to bedrock than Wellston soils. The other associated soils are not so well drained and have a fragipan, and Calloway soils are gray in the upper part of the subsoil.

Typical pedon of Wellston silt loam, 6 to 12 percent slopes, 8 miles south of Greenville, 1 mile east of Pond River, and 1/2 mile southeast of Kentucky Highway 189, on top of hill, in Muhlenberg County:

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; moderate fine granular structure; very friable; many roots; medium acid; clear smooth boundary.

B21t—8 to 30 inches; strong brown (7.5YR 5/6) heavy silt loam; moderate fine subangular blocky structure; friable; many roots; brown (7.5YR 4/4) clay films; very strongly acid; gradual smooth boundary.

IIB22t—30 to 40 inches; mottled brown (7.5YR 4/4) and light gray (10YR 7/2) silt loam; weak medium subangular blocky structure; friable; few patchy clay films; few roots; few pores; very strongly acid; gradual smooth boundary.

IIC—40 to 52 inches; yellowish brown (10YR 5/6) loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; 10 percent sandstone fragments 1/2 inch to 1 1/2 inches in diameter; very strongly acid.

R—52 inches; soft sandstone bedrock.

The thickness of the solum ranges from 32 to 48 inches. Depth to bedrock ranges from 40 to 72 inches. In unlimed areas reaction ranges from strongly acid to very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Soils in wooded areas have an A1 horizon that has hue of 10YR, value of 3, and chroma of 3 and an A2 horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. The IIB22t horizon has light gray or pale brown mottles. The B2t horizon is heavy silt loam or light silty clay loam. This horizon has strong to weak and fine or medium structure. Consistence is firm or friable. Pebbles and cobbles range in content from 0 to 20 percent and are mostly in the IIB22t horizon.

The C horizon is mottled in shades of brown and gray. Content of pebbles and cobbles ranges from 5 to 40 percent. The fine earth fraction ranges from silt loam to clay loam or loam. In some pedons the C horizon has coarse subangular blocky structure.

Zanesville series

The Zanesville series consists of deep, well drained to moderately well drained soils that formed in loess and the underlying residuum from sandstone and siltstone. These soils are on hilltops and side slopes on uplands in the central and southern part of the survey area. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 2 to 12 percent.

Zanesville soils are geographically associated with Wellston, Frondorf, Lenberg, Caneyville, Sadler, Grenada, and Calloway soils. Wellston, Frondorf, Lenberg, and Caneyville soils do not have a fragipan; Frondorf, Lenberg, and Caneyville soils are not so deep to bedrock; and Lenberg and Caneyville soils have more clay in the subsoil. Sadler, Grenada, and Calloway soils are bisequal; Grenada and Calloway soils are deeper to bedrock; and Calloway soils are not so well drained and are gray in the upper part of the subsoil.

Typical pedon of Zanesville silt loam, 6 to 12 percent slopes, 3 miles east of Weir and 3/4 mile west of State Highway 181 and Carter Creek Church, at bend in road, in Muhlenberg County:

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; moderate fine granular structure; very friable; many roots; neutral; abrupt smooth boundary.

B2t—8 to 30 inches; strong brown (7.5YR 5/6) heavy silt loam; moderate fine subangular blocky structure; friable; few roots; continuous brown (7.5YR 4/4) clay films; strongly acid; clear wavy boundary.

Bx—30 to 40 inches; mottled yellowish brown (10YR 5/6), brown (7.5YR 4/4), and light gray (10YR 7/2) heavy silt loam; moderate very coarse prismatic structure parting to moderate fine subangular blocky; firm, brittle, and compact; few roots between prisms; gray silt and clay coatings on prisms; patchy clay films on blocks; strongly acid; gradual smooth boundary.

IICx—40 to 50 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct light gray (10YR 7/2) mottles; massive; firm, brittle, and compact; strongly acid; gradual smooth boundary.

IIC—50 to 70 inches; mottled yellowish brown (10YR 5/6) and reddish brown (5YR 4/4) light clay loam; massive; firm; about 2 percent sandstone fragments 1/4 to 1 inch in diameter; strongly acid.

R—70 inches; sandstone bedrock.

The thickness of the solum ranges from 34 to 60 inches. Depth to bedrock ranges from 40 to 80 inches. Depth to the fragipan is 24 to 32 inches in uneroded pedons. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3.

The B2t horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 or 6. In some pedons the lower 10 inches has hue of 10YR, and the lower 5 inches is mottled. This horizon is heavy silt loam or light silty clay loam.

The Bx horizon is mottled in hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 6. It is light silty clay loam, silt loam, or loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 6. In some pedons the IICx horizon

has prismatic or subangular blocky structure. Some pedons do not have a IIC horizon, and the IICx horizon is underlain by bedrock. The IIC horizon ranges from silt loam to sandy clay loam or their gravelly or channery analogs.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Fluvaquents (*Fluv*, meaning on a flood plain, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, nonacid, mesic, Typic Fluvaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this section, the processes of soil formation are discussed and related to the soils in the survey area.

Soils formed through the interaction of climate, plant and animal life, parent material, relief, and time. Climate and plant and animal life act on the parent materials, and their effect is conditioned by relief and the length of time that they have been active.

All five factors were active in the formation of soils. The relative importance of each differs from place to place and accounts for varying characteristics of the soils. In some places one factor is dominant in influencing the soil characteristics, and in other places another factor is dominant. Each factor modifies the effect of the other four.

The five factors and their effect on the soils of McLean and Muhlenberg Counties are discussed in the following paragraphs.

Climate

The climate of McLean and Muhlenberg Counties is humid and temperate. Generally, summers are warm, winters are cool, and precipitation is distributed throughout the year. Presumably, the present climate is similar to the climate that was in this area during the time the soils formed.

Climate affects the erosion, the weathering of geologic materials, and the kind and number of plants and animals. Water from rainfall alters the geologic materials as it runs off or percolates through the soil. On upland soils, such as Memphis and Wellston soils, water has leached soluble bases from the soils and moved clays from upper layers to lower layers. Water and temperature affect plant and animal life, which grows mostly in wet, warm seasons.

Because soils in this survey area are neither frozen nor dry for long periods, soil-forming processes are active throughout the year. However, because the climate is uniform throughout the survey area, factors other than climate caused the differences in the soils.

Plant and animal life

Plants and animals are active in soil formation in McLean and Muhlenberg Counties. They add organic matter, especially to the surface layers. Bacteria and fungi decay the organic matter and release plant nutrients. Plant roots penetrate the subsoil and obtain plant nutrients. The plants then die and add organic matter and plant nutrients to the surface soil. Animals, such as moles, mice, groundhogs, and crayfish, burrow through and mix the soils. Many forms of small animal life, such as earthworms, grubs, and insects, live in and on the soil and alter it, but plants generally have influenced soils more than animals.

The native vegetation of the area was hardwood forests. The older soils, such as Zanesville and Wellston soils, have characteristics that are typical of soils that formed under hardwood forests. These soils are acid, and they have a thin, dark surface layer; a leached subsurface layer; and a subsoil that has more clay than either the surface layer or the substratum.

Man has altered the soil by removing trees and mixing the surface layers into a plow layer. In a few places he has leveled or graded the soil or even mixed the soil with the underlying bedrock. He also has accelerated erosion on the uplands and increased deposition on the flood plains. Nevertheless, except for altering the surface layers, his influence on soil formation has been minor in most places.

Parent material

Parent material is the unconsolidated mass of geologic material in which the soils formed. It varies widely and accounts for many of the differences in the soils. The parent materials of soils in McLean and Muhlenberg Counties are loess, alluvium, and residuum derived from bedrock.

Loess, a wind-deposited silt, is on most of the uplands. It is thickest in the northern part of the survey area and ranges from about 15 feet thick on gentle slopes in the northwestern part of McLean County to 1 foot or less on steep slopes in the southern part of Muhlenberg County. Memphis, Loring, and Grenada soils, which are mainly in McLean County, formed in loess more than 4 feet thick.

The bedrock under the loess is interbedded sandstone, siltstone, shale, and limestone. The weathered upper part of the bedrock is residuum that is the parent material of part of the soils. Most of the soils where the loess is less than 4 feet thick formed partly in loess and partly in underlying residuum. Wellston, Frondorf, Zanesville, and Sadler soils formed in loess and residuum derived from sandstone and siltstone.

Soils that formed in residuum derived from shale or from limestone have a high content of clay. The Lenberg soils formed mostly in residuum derived from shale, and Caneyville soils formed mostly in residuum derived from limestone. These soils have a clayey subsoil.

The alluvium either washed from the nearby uplands in the survey area, or it came down the rivers from outside the survey area. The alluvium in the narrow valleys has a high content of silt and came from the nearby loess-covered uplands. Vicksburg, Collins, Belknap, and Waverly soils formed in alluvium that washed mostly from loess.

The Green River, which has a large drainage area, has brought in alluvium from a variety of parent materials. Soils in the Green River Valley, which have mixed parent materials, are Elk, Otwell, Henshaw, Nolin, Lindside, Newark, and Melvin soils. The Green River Valley also has soils that formed in alluvium deposited in slack water. Such soils, which contain a high content of clay, are Karnak, McGary, and Markland soils.

Relief

Relief influences the soils and is responsible for many of the differences in the soils in the survey area. It affects drainage, erosion, plant cover, soil temperature, and depth of soil. In McLean and Muhlenberg Counties relief ranges from nearly level to steep.

Most nearly level soils are somewhat poorly drained or poorly drained, most gently sloping soils are moderately well drained, and most sloping to steep soils are well drained. Soils that have excess water for long periods of time have a gray subsoil that is characteristic of poorly drained or somewhat poorly drained soils. Waverly soils are poorly drained, and Belknap soils are somewhat poorly drained. Soils that have a subsoil that is mostly brown and has a few gray mottles are moderately well drained. Lindside soils and Grenada soils are moderately well drained. Most soils that have a brown subsoil are well drained. Memphis, Wellston, and Nolin soils are well drained.

The fragipan, a characteristic of some soils that have impeded drainage, forms only in soils that are mostly nearly level to sloping. Soils that have a fragipan are on stream terraces or uplands and are higher than adjacent soils. Calloway, Grenada, Loring, Otwell, Sadler, and Zanesville soils have a fragipan.

Relief also affects the thickness of loess on the uplands. The loess is thicker on gentle slopes than it is on steeper slopes. Some soils that are gently sloping or sloping such as Memphis soils and Grenada soils formed in loess. Soils that are strongly sloping to steep formed either in loess and residuum or entirely in residuum. Wellston soils and Frondorf soils formed in loess and residuum, and Lenberg soils and Caneyville soils formed in residuum. Some strongly sloping to steep soils are not so

deep to bedrock as most soils in the survey area. The Frondorf, Lenberg, and Caneyville soils are less deep to bedrock.

The direction of slope slightly affects soil temperature and plant cover. Because south-facing slopes freeze and thaw more frequently than north-facing slopes, weathering and erosion may be slightly more on south-facing slopes. Plant cover also differs slightly on north-facing and south-facing slopes. The differences in soil temperature and plant cover caused by slopes; however, have not greatly affected soil formation.

Time

The length of time that soil-forming processes have been active determines the amount of profile development. Generally, an old soil has a well developed soil profile and a young soil has a weakly developed soil profile. A well developed soil profile has distinct soil horizons. Soils in McLean and Muhlenberg Counties have a range from well developed to weakly developed profiles.

Soils that formed in residuum are the oldest soils in the survey area, and soils that formed in loess are the next oldest. Most of the soils on uplands formed in loess or partly in loess and have well developed soil profiles. The loess dates from near the end of the Ice Age and presumably these soils have been forming for thousands of years. Memphis, Zanesville, and Caneyville soils are examples of soils that have well developed profiles.

Most soils that formed on stream terraces in the Green River Valley also have well developed soil profiles. These soils are as old or almost as old as the soils that formed in loess (*5*). Elk, Otwell, Markland, and McGary soils are examples of these soils.

Soils that formed in recent alluvium on flood plains are mainly young soils. Belknap, Waverly, Nolin, and Lindside soils are alluvial soils that have weakly developed soil profiles.

Morphology of the soils

The soil profile forms as a result of the interaction of the soil-forming factors. It is a succession of layers, or horizons, that extends from the surface down to materials that are little affected by soil-forming processes. The kind, properties, and prominence of the horizons in the soil profile is the morphology of the soils. This subsection explains the major soil horizons and some processes in their formation.

Major soil horizons

Most soil profiles have three master horizons, identified by the letters A, B, and C. In most profiles the master horizons are subdivided, and subdivisions are identified by the letter plus an arabic number or a small case letter. Examples are A1, A2, B2t, and Bg. The identifying symbol for each subdivision provides a clue to the morphology of that horizon.

The A horizon is the uppermost layer in the soil profile. It is the part of the soil in which plant and animal life are most abundant. It is, therefore, the part that contains the most organic matter; and because it is at the surface, it is leached more than the deeper horizons. Many A horizons are subdivided into A1 and A2 horizons. The A1 horizon is a thin surface layer that has been darkened by organic matter. The A2 horizon is a thicker, light colored, more leached layer below the A1 horizon. In many soils, the A1 and A2 horizons have been mixed into a plow layer, and identified with the symbol Ap.

The B horizon is directly below the A horizon and is the subsoil. It is between the A and C horizons and has some properties of both. It has less organic matter than the A horizon, and in some soils it has more clay than the A or C horizons. The B horizon may have granular, blocky, or prismatic structure and is firmer than the A or C horizons. It may have enough iron oxide or aluminum oxide to give it darker, stronger, or redder colors than other horizons.

The C horizon is the deepest of the major horizons. It is little affected by soil-forming processes. In soils that formed in residuum, the C horizon is the loose and partly decayed rock below the B horizon. In soils that formed in loess or alluvium the C horizon does not have the properties of the A or B horizon. The C horizon has weak structure or is massive and has a lower content of organic matter than the A or B horizon.

Soil horizon differentiation

Soil formation proceeds in steps and stages, none of which is distinct. The major steps in the formation of soils are the accumulation of parent materials and the development of horizons in the profile. Parent materials come from the weathering of rocks. They may have accumulated in place by the breakdown of hard rock, or they may have been moved by wind or water.

Horizons develop in soil profiles because of gains, losses, transfers, and alterations. Soils in McLean and Muhlenberg Counties have gained organic matter, and they have lost soluble salts. Clay minerals have been formed and transferred; iron has been reduced and transferred. In most soils these changes have been continuing for thousands of years. Gains in organic matter are from remains of plants and animals that lived in and on the soil. Plant and animal residue rapidly decay and form humus that remains in the soil. Because more organic matter accumulates in surface horizons than in lower horizons, most soils have a dark A1 horizon.

Losses from the soil are due mainly to leaching or eluviation. Leaching by percolating water has removed soluble materials from the soil. Presumably when the loess blew in, it was calcareous, but soils that formed in loess are now essentially free of calcium carbonate. The

acid reaction of most soils is evidence that calcium carbonate and other bases have been leached from the soil.

Eluviation by water has also moved silicate clays from the surface horizons to the subsoil of some soils. The B horizon of soils on uplands and stream terraces has more clay than the A or C horizons and has blocky or subangular blocky structure and clay films on ped surfaces. Some clay minerals also formed in the B horizon as a result of weathering and decomposition of minerals.

The reduction and transfer of iron is associated mostly with wet soils. The gray colors of the poorly drained and somewhat poorly drained soils are due to the chemical reduction of iron, a process called gleying. Associated with gleying is the cementing of iron into brown concretions and some movement of iron. Well drained soils generally are brown because iron is not reduced but is oxidized.

Many somewhat poorly drained and moderately well drained soils on uplands and stream terraces have a fragipan in the subsoil. The fragipan is a very firm, brittle, and compact layer that has high bulk density, is generally mottled, and is very slowly permeable. The genesis of the fragipan is obscure, but factors that contributed to its formation may include wetting and drying, illuviation, and the weight of the overlying horizons. Soils that have a fragipan are nearly level to sloping, have impeded drainage, and are not the youngest soils in the survey area.

In McLean and Muhlenberg Counties most soils on uplands and stream terraces have distinct profile development. Most soils have an A1 horizon and an A2 horizon or a plow layer that is a mixture of the two horizons. They are leached of bases and have a B horizon that has more silicate clay than the A or C horizons. Some soils on uplands and stream terraces also have a fragipan, and some are gleyed.

Most soils on flood plains have weak profile development. They do not have a fragipan, and silicate clays have not moved from the A horizon to the B horizon. They do have an A1 horizon, and some soils are gleyed. They have properties of soils in early stages of soil formation.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	More than 5.2

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16

supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for

example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine*

sand (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitaion is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Illustrations

Figure 1.—Oil is an important natural resource in the area.

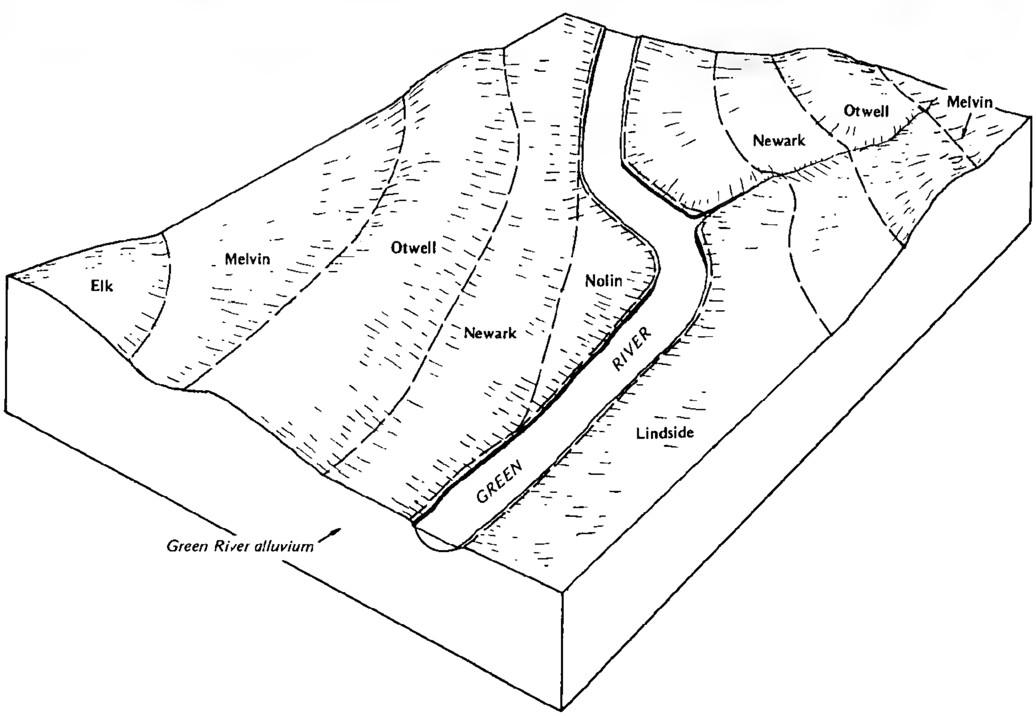

Figure 2.—Relationship of soils to topography and underlying material in the Newark-Otwell-Melvin map unit.

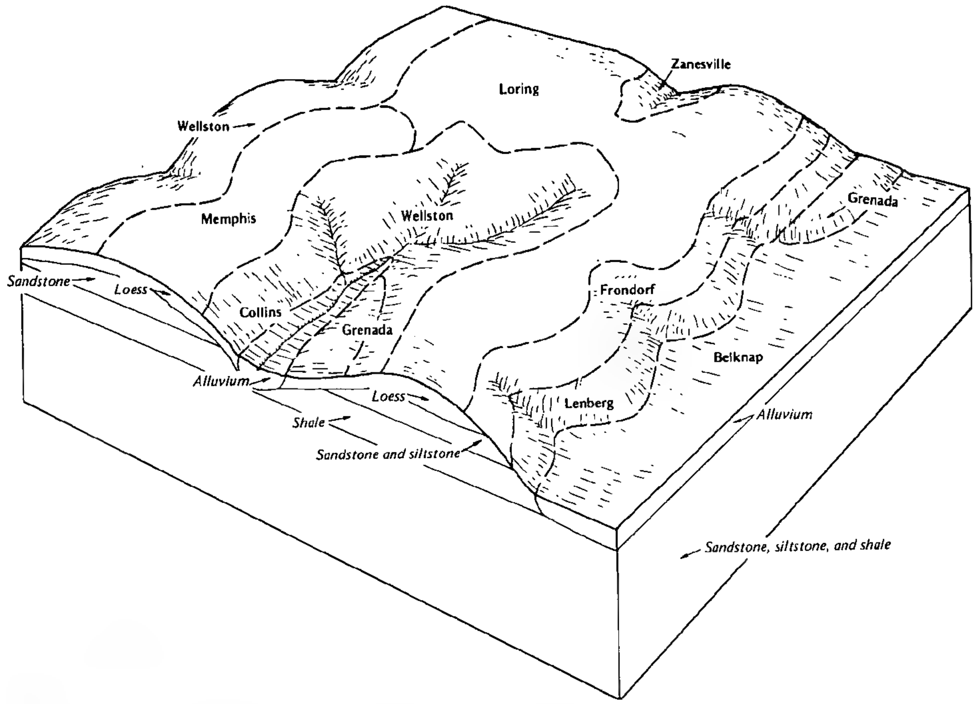

Figure 3.—Relationship of soils to topography and underlying material in the Loring-Wellston map unit.

Figure 4.—The soils in the foreground are Udorthents in strip mine spoil. They have been planted to grasses, legumes, and pines. Soil that has not been mined is Memphis silt loam, 2 to 6 percent slopes, and Wellston loam, 20 to 30 percent slopes.

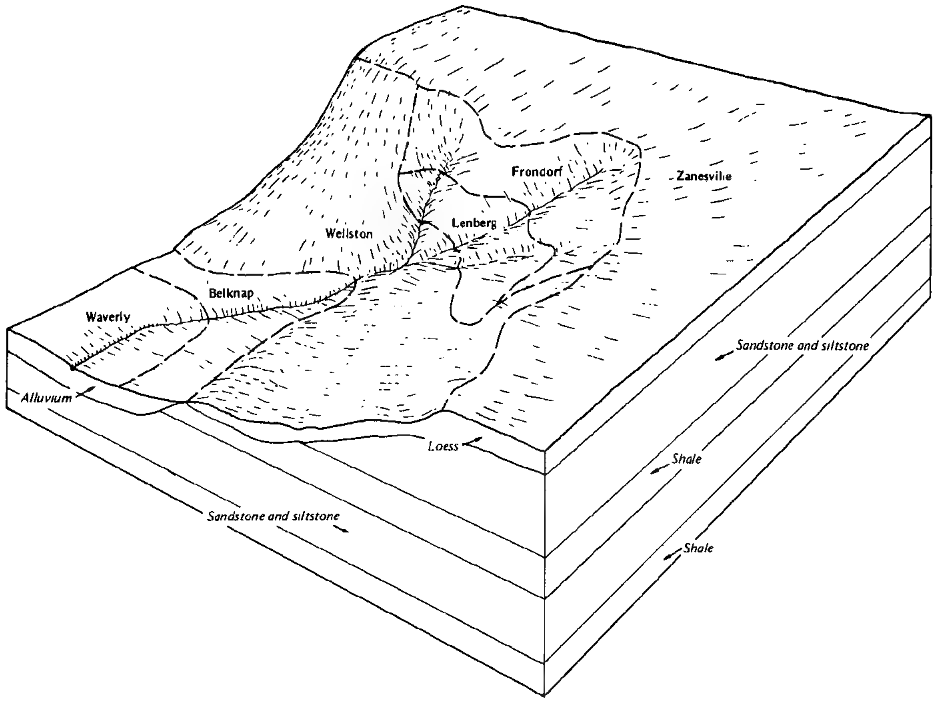

Figure 5.—Relationship of soils to topography and underlying material in the Zanesville-Wellston-Frondorf map unit.

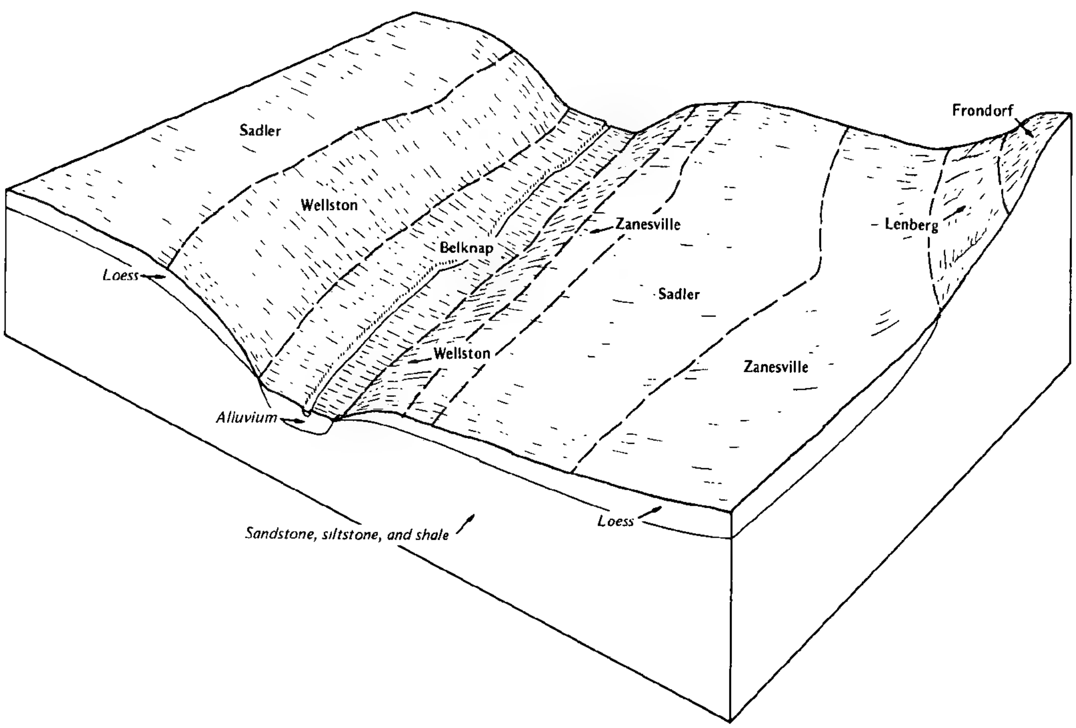

Figure 6.—Relationship of soils to topography and underlying material in the Sadler-Zanesville-Wellston map unit.

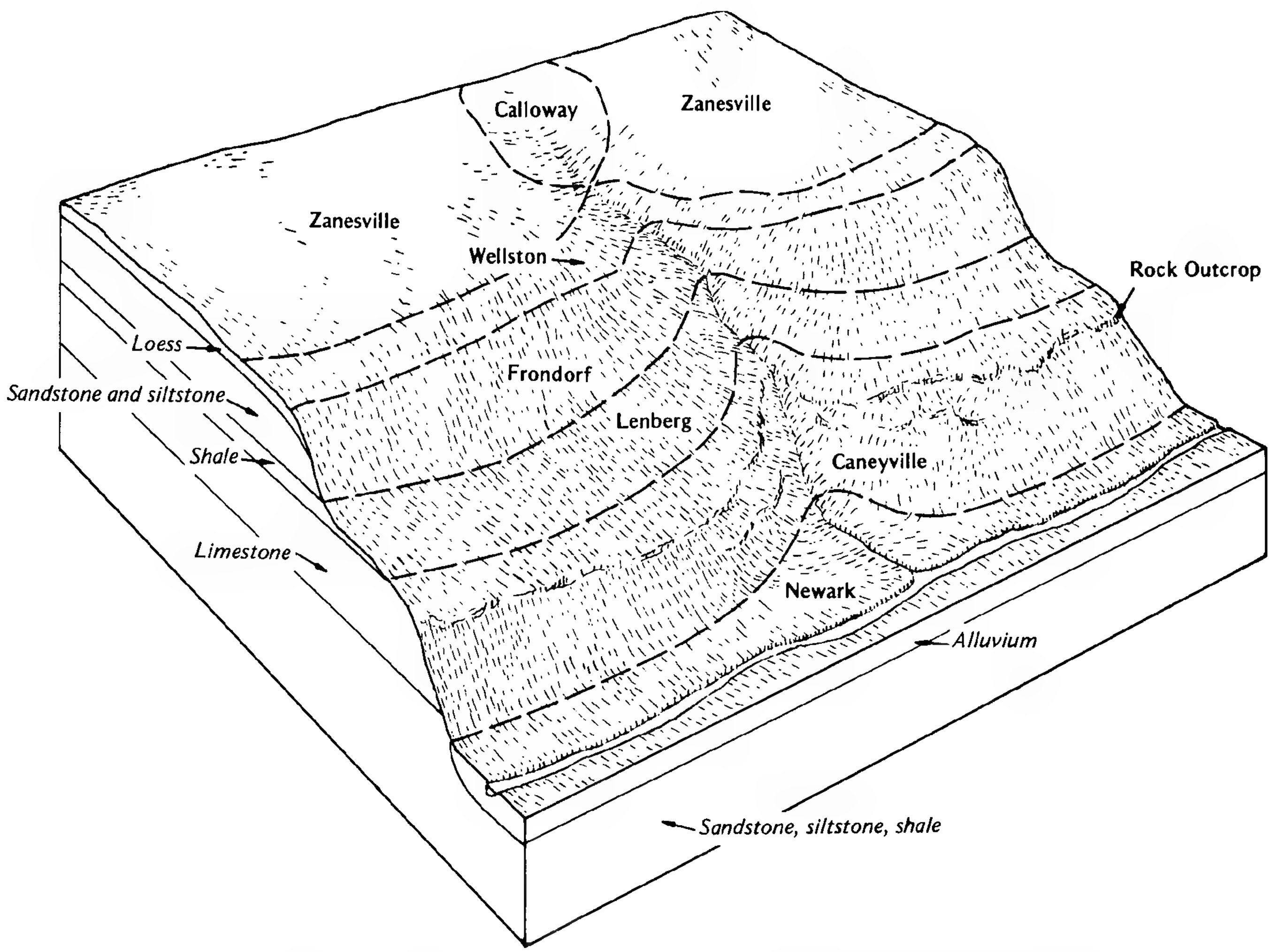

Figure 7.—Relationship of soils to topography and underlying material in the Caneyville-Zanesville-Frondorf map unit.

Figure 8.—Farm building and tobacco on Nolin silt loam and soybeans on Newark silt loam. The Nolin soil is on a low ridge parallel to Green River and is better drained than Newark soils.

Figure 9.—A bathing beach in Lake Malone State Park. The lake is a combination floodwater control structure and recreation area. The soil in the wooded background is Frondorf-Lenberg complex, 30 to 50 percent slopes.

Figure 10.—Tobacco growing and being harvested on Collins silt loam. Corn in the background is on Belknap silt loam.

Figure 11.—Soybeans on Karnak silty clay. The soil has poor workability but is well suited to soybeans if it is drained.

Figure 12.—Corn damaged by too much water by heavy rainfall on nearly level McGary silt loam. Permeability in the subsoil is slow.

Figure 13.—Grass and legume hay on Sadler silt loam, 2 to 6 percent slopes, in the foreground and Zanesville silt loam, 6 to 12 percent slopes, in the background.

Figure 14.—Udorthents in a strip mine area.

Figure 15.—An area of Waverly silt loam, depressional. Most of this soil supports water-tolerant vegetation.

Figure 16.—Corn planted in an established sod of Kentucky 31 fescue. No-till planting is an excellent erosion control practice. The soil is Zanesville silt loam, 2 to 6 percent slopes.

Figure 17.—Hardwood trees on Zanesville silt loam, 6 to 12 percent slopes. This soil has good potential for trees.

Figure 18.—Grassed waterway and tobacco on Belknap silt loam. Corn in the background is on Loring silt loam, 6 to 12 percent slopes, severely eroded.

Figure 19.—The hazard of flooding limits the use of some soils. Most floods take place when cultivated crops are not growing.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	43.3	25.6	34.5	70	-6	6	3.58	1.85	4.99	7	4.4
February----	47.6	28.3	37.9	73	0	17	3.50	1.76	4.92	7	3.1
March-------	56.7	35.7	46.2	81	13	104	4.59	2.45	6.33	8	3.2
April-------	69.5	46.7	58.1	88	26	255	4.47	2.46	6.11	8	.0
May---------	78.4	55.2	66.7	93	35	518	4.62	2.82	6.22	8	.0
June--------	86.9	63.2	75.1	99	46	753	3.60	1.89	4.99	7	.0
July--------	89.9	66.6	78.3	99	51	877	3.43	1.84	4.72	6	.0
August------	89.2	64.3	76.7	99	50	828	3.05	1.32	4.45	5	.0
September---	83.6	58.0	70.8	98	38	624	3.11	1.70	4.25	5	.0
October-----	72.9	46.1	59.5	91	26	307	2.15	.86	3.20	5	.0
November----	57.6	36.3	46.9	82	14	39	3.68	1.88	5.15	6	.9
December----	46.5	29.4	38.0	71	2	24	3.79	2.08	5.18	8	1.5
Year------	68.5	46.3	57.4	102	-9	4,352	43.57	37.26	49.64	80	13.1

[1]Recorded in the period 1951-74 at Owensboro, Ky.

[2]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 2	April 13	April 22
2 years in 10 later than--	March 27	April 9	April 17
5 years in 10 later than--	March 17	April 1	April 9
First freezing temperature in fall:			
1 year in 10 earlier than--	October 29	October 22	October 7
2 years in 10 earlier than--	November 3	October 26	October 12
5 years in 10 earlier than--	November 12	November 2	October 22

[1]Recorded in the period 1951-74 at Owensboro, Ky.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	221	197	179
8 years in 10	227	203	185
5 years in 10	239	214	196
2 years in 10	251	225	206
1 year in 10	258	231	212

[1]Recorded in the period 1951-74 at Owensboro, Ky.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	McLean County	Muhlenberg County	Total-- Area	Extent
		Acres	Acres	Acres	Pct
Be	Belknap silt loam	25,590	25,770	51,360	10.8
Ca	Calloway silt loam, 0 to 2 percent slopes	3,140	1,890	5,030	1.1
CcC	Caneyville silt loam, 6 to 12 percent slopes	0	990	990	0.2
CcD	Caneyville silt loam, 12 to 20 percent slopes	0	1,380	1,380	0.3
CdE	Caneyville-Rock outcrop complex, 12 to 30 percent slopes	0	3,150	3,150	0.7
Cg	Clifty gravelly silt loam	0	1,490	1,490	0.3
Co	Collins silt loam	5,890	5,460	11,350	2.4
Du	Dumps	0	540	540	0.1
ElB	Elk silt loam, 2 to 6 percent slopes	270	340	610	0.1
ElC	Elk silt loam, 6 to 12 percent slopes	110	140	250	0.1
FlD	Frondorf-Lenberg complex, 12 to 20 percent slopes	290	23,920	24,210	5.1
FlE	Frondorf-Lenberg complex, 20 to 30 percent slopes	320	19,560	19,880	4.2
FlF	Frondorf-Lenberg complex, 30 to 50 percent slopes	1,460	7,290	8,750	1.9
GrA	Grenada silt loam, 0 to 2 percent slopes	1,000	500	1,500	0.3
GrB	Grenada silt loam, 2 to 6 percent slopes	14,110	6,530	20,640	4.4
He	Henshaw silt loam	3,680	560	4,240	0.9
Ko	Karnak silt loam, overwash	3,490	980	4,470	0.9
Ks	Karnak silty clay	9,750	3,320	13,070	2.8
Ld	Lindside silt loam	880	2,520	3,400	0.7
LoB	Loring silt loam, 2 to 6 percent slopes	6,990	2,530	9,520	2.0
LoC	Loring silt loam, 6 to 12 percent slopes	7,870	1,910	9,780	2.1
LoC3	Loring silt loam, 6 to 12 percent slopes, severely eroded	11,740	860	12,600	2.7
LoD	Loring silt loam, 12 to 20 percent slopes	160	0	160	*
LoD3	Loring silt loam, 12 to 20 percent slopes, severely eroded	1,780	0	1,780	0.4
MaE	Markland soils, 12 to 35 percent slopes	720	0	720	0.2
Mc	McGary silt loam	8,280	3,050	11,330	2.4
Me	Melvin silt loam	20,760	9,010	29,770	6.3
MmB	Memphis silt loam, 2 to 6 percent slopes	1,300	0	1,300	0.3
MmC	Memphis silt loam, 6 to 12 percent slopes	1,470	0	1,470	0.3
Ne	Newark silt loam	3,600	5,790	9,390	2.0
Nh	Nolin silt loam	1,350	1,850	3,200	0.7
Nm	Nolin-Melvin complex	770	110	880	0.2
OtA	Otwell silt loam, 0 to 2 percent slopes	940	140	1,080	0.2
OtB	Otwell silt loam, 2 to 6 percent slopes	1,700	720	2,420	0.5
Pt	Pits	50	370	420	0.1
SaA	Sadler silt loam, 0 to 2 percent slopes	0	630	630	0.1
SaB	Sadler silt loam, 2 to 6 percent slopes	0	21,420	21,420	4.5
Ud	Udorthents	1,140	43,750	44,890	9.5
Vc	Vicksburg silt loam	120	860	980	0.2
Wa	Waverly silt loam	2,660	10,360	13,020	2.8
Wd	Waverly silt loam, depressional	0	2,820	2,820	0.6
We	Weinbach silt loam	1,690	700	2,390	0.5
WlB	Wellston silt loam, 2 to 6 percent slopes	0	960	960	0.2
WlC	Wellston silt loam, 6 to 12 percent slopes	430	11,110	11,540	2.4
WlC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	210	8,120	8,330	1.8
WlD	Wellston silt loam, 12 to 20 percent slopes	3,040	11,830	14,870	3.2
WlD3	Wellston silt loam, 12 to 30 percent slopes, severely eroded	11,040	10,430	21,470	4.5
WlE	Wellston silt loam, 20 to 30 percent slopes	3,540	210	3,750	0.8
ZaB	Zanesville silt loam, 2 to 6 percent slopes	0	22,560	22,560	4.8
ZaC	Zanesville silt loam, 6 to 12 percent slopes	600	25,130	25,730	5.4
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	550	3,960	4,510	1.0
	Total	164,480	307,520	472,000	100.0

* Less than 0.05 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Wheat	Soybeans	Tobacco	Grass-legume hay	Pasture
	Bu	Bu	Bu	Lb	Ton	AUM*
Be------ Belknap	105	---	40	---	4.5	8.5
Ca------ Calloway	80	---	35	---	4.0	7.5
CcC------ Caneyville	70	---	---	---	3.5	6.5
CcD------ Caneyville	---	---	---	---	3.0	5.0
CdE**------ Caneyville	---	---	---	---	---	---
Cg------ Clifty	110	30	---	---	4.5	8.5
Co------ Collins	110	40	40	---	4.5	8.5
Du. Dumps						
ElB------ Elk	115	45	40	3,000	4.0	7.0
ElC------ Elk	100	40	35	2,600	4.0	7.0
FlD**------ Frondorf	80	30	---	---	2.5	5.0
FlE**------ Frondorf	---	---	---	---	2.5	4.5
FlF**------ Frondorf	---	---	---	---	---	2.7
GrA------ Grenada	100	40	35	2,350	4.0	7.5
GrB------ Grenada	100	45	30	2,550	4.0	7.5
He------ Henshaw	110	45	45	---	4.0	7.5
Ko, Ks------ Karnak	105	---	35	---	3.5	7.0
Ld------ Lindside	110	---	45	---	4.5	8.5
LoB------ Loring	105	40	30	2,550	4.0	7.0
LoC------ Loring	85	35	25	2,450	4.0	7.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Wheat	Soybeans	Tobacco	Grass-legume hay	Pasture
	Bu	Bu	Bu	Lb	Ton	AUM*
LoC3-----------------------Loring	60	30	20	---	3.5	6.0
LoD------------------------Loring	60	30	---	---	3.5	6.5
LoD3-----------------------Loring	---	---	---	---	2.5	4.5
MaE------------------------Markland	---	---	---	---	3.0	5.5
Mc-------------------------McGary	85	---	35	---	3.0	6.0
Me-------------------------Melvin	90	---	35	---	3.5	7.0
MmB------------------------Memphis	110	45	40	3,000	4.5	8.5
MmC------------------------Memphis	100	45	35	2,600	4.0	7.5
Ne-------------------------Newark	100	---	40	---	4.5	8.5
Nh-------------------------Nolin	110	---	45	3,000	4.5	8.5
Nm**-----------------------Nolin	---	---	---	---	---	---
OtA------------------------Otwell	105	40	35	2,800	3.5	7.0
OtB------------------------Otwell	105	40	35	2,800	3.5	7.0
Pt. Pits						
SaA------------------------Sadler	100	40	30	2,350	3.5	7.0
SaB------------------------Sadler	100	40	30	2,550	3.5	7.0
Ud-------------------------Udorthents	---	---	---	---	---	---
Vc-------------------------Vicksburg	115	40	40	---	4.5	8.5
Wa-------------------------Waverly	100	---	30	---	3.5	7.5
Wd-------------------------Waverly	---	---	---	---	---	---
We-------------------------Weinbach	90	---	30	---	3.5	7.5
WlB------------------------Wellston	105	40	40	3,000	4.0	7.5

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Wheat	Soybeans	Tobacco	Grass-legume hay	Pasture
	Bu	Bu	Bu	Lb	Ton	AUM*
W1C----------------------- Wellston	100	40	35	2,800	4.0	7.5
W1C3---------------------- Wellston	80	30	---	---	3.5	6.5
W1D----------------------- Wellston	95	30	---	---	3.5	7.0
W1D3---------------------- Wellston	---	---	---	---	3.0	6.0
W1E----------------------- Wellston	---	---	---	---	3.0	6.0
ZaB----------------------- Zanesville	100	40	35	2,700	3.5	7.0
ZaC----------------------- Zanesville	90	35	30	2,450	3.5	7.0
ZaC3---------------------- Zanesville	60	25	---	---	3.0	5.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	18,930	---	---	---
II	149,120	74,430	68,200	1,490
III	127,850	48,770	79,080	---
IV	65,670	65,670	---	---
V	2,820	---	2,820	---
VI	48,980	48,980	---	---
VII	12,780	9,630	---	3,150
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that the information was not available. Site index was calculated at age 30 for eastern cottonwood, at age 35 for American sycamore, and at age 50 for all other species]

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedl'ng mortal-ity	Management concerns: Plant competi-tion	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Be------------------ Belknap	2w	Slight	Moderate	Slight	Severe	Eastern cottonwood-- Yellow-poplar-------- Pin oak--------------	100 90 90	Eastern cottonwood, red maple, American sycamore, sweetgum, baldcypress.
Ca------------------ Calloway	2w	Slight	Moderate	Slight	Moderate	Cherrybark oak------- Loblolly pine------- Shortleaf pine------ Sweetgum------------ Water oak-----------	90 90 80 90 90	Cherrybark oak, white oak, sweetgum, white ash, yellow-poplar, cottonwood.
CcC----------------- Caneyville	3c	Slight	Slight	Moderate	Slight	Northern red oak---- Yellow-poplar-------- Eastern redcedar----	69 80 45	Eastern redcedar, Virginia pine, eastern white pine, shortleaf pine, loblolly pine.
CcD--(north aspect) Caneyville	2c	Moderate	Moderate	Moderate	Moderate	Yellow-poplar-------- Black oak-----------	90 80	Yellow-poplar, black walnut, Virginia pine.
CcD--(south aspect) Caneyville	3c	Moderate	Moderate	Moderate	Slight	Scarlet oak---------- Eastern redcedar----	69 45	Eastern redcedar, Virginia pine, eastern white pine, shortleaf pine, loblolly pine.
CdE*: Caneyville-(north)	2c	Moderate	Moderate	Moderate	Moderate	Yellow-poplar-------- Black oak-----------	90 80	Yellow-poplar, black walnut, Virginia pine.
Rock outcrop.								
CdE*: Caneyville-(south)	3c	Moderate	Moderate	Moderate	Slight	Scarlet oak---------- Eastern redcedar----	69 45	Eastern redcedar, Virginia pine, eastern white pine, shortleaf pine, loblolly pine.
Rock outcrop.								
Cg------------------ Clifty	1o	Slight	Slight	Slight	Severe	Pin oak-------------- Sweetgum------------ Shortleaf pine------ Yellow-poplar-------- Northern red oak----	95 95 76 72 64	Yellow-poplar, sweetgum, white ash, eastern cottonwood, shortleaf pine, eastern white pine, cherrybark oak.
Co------------------ Collins	1o	Slight	Slight	Slight	Severe	Green ash------------ Eastern cottonwood-- Cherrybark oak-------	95 115 110	Green ash, eastern cottonwood, cherrybark oak.
ElB, ElC------------ Elk	2o	Slight	Slight	Slight	Severe	Northern red oak---- Yellow-poplar-------- Shortleaf pine------ Eastern white pine--	80 90 80 90	Eastern white pine, yellow-poplar, black walnut, loblolly pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
FlD*:								
Frondorf-(north)	2r	Moderate	Moderate	Slight	Moderate	Northern red oak	86	Yellow-poplar, shortleaf pine, black walnut, eastern white pine, loblolly pine.
FlD*:								
Lenberg-(north)	3c	Moderate	Slight	Slight	Moderate	Northern red oak	70	Eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
FlD*:								
Frondorf-(south)	3r	Moderate	Moderate	Moderate	Moderate	Black oak	70	Shortleaf pine, loblolly pine, Virginia pine.
Lenberg-(south)	4c	Moderate	Slight	Slight	Slight	White oak Scarlet oak	60 60	Virginia pine, eastern redcedar.
FlE*:								
Frondorf-(north)	2r	Moderate	Moderate	Slight	Moderate	Northern red oak	86	Yellow-poplar, shortleaf pine, black walnut, eastern white pine, loblolly pine.
Lenberg-(north)	3c	Severe	Moderate	Slight	Moderate	Northern red oak	70	Eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
FlE*:								
Frondorf-(south)	3r	Moderate	Moderate	Moderate	Moderate	Black oak	70	Shortleaf pine, loblolly pine, Virginia pine.
Lenberg-(south)	4c	Severe	Moderate	Slight	Slight	White oak Scarlet oak	60 60	Virginia pine, eastern redcedar.
FlF*:								
Frondorf-(north)	2r	Severe	Severe	Slight	Moderate	Northern red oak	86	Yellow-poplar, shortleaf pine, black walnut, eastern white pine, loblolly pine.
Lenberg-(north)	3c	Severe	Moderate	Slight	Moderate	Northern red oak	70	Eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
FlF*:								
Frondorf-(south)	3r	Severe	Severe	Moderate	Moderate	Black oak	70	Shortleaf pine, loblolly pine, Virginia pine.
Lenberg-(south)	4c	Severe	Moderate	Slight	Slight	White oak Scarlet oak	60 60	Virginia pine, eastern redcedar.
GrA, GrB Grenada	3o	Slight	Slight	Slight	Moderate	Cherrybark oak Southern red oak Loblolly pine Shortleaf pine Sweetgum	85 80 85 75 80	Cherrybark oak, loblolly pine, sweetgum, white ash, white oak, yellow-poplar.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Important trees	Site index	Trees to plant
He Henshaw	1w	Slight	Moderate	Slight	Moderate	Pin oak Yellow-poplar Sweetgum	95 95 95	White ash, sweetgum, eastern cottonwood, yellow-poplar.
Ko, Ks Karnak	1w	Slight	Moderate	Severe	Severe	Pin oak	90	Pin oak, swamp white oak, eastern cottonwood, green ash, red maple, baldcypress, sweetgum, water tupelo, pecan.
Ld Lindside	1w	Slight	Moderate	Slight	Severe	Northern red oak Yellow-poplar	85 95	Eastern white pine, yellow-poplar, black cherry, black walnut.
LoB, LoC, LoC3 Loring	3o	Slight	Slight	Slight	Severe	Cherrybark oak Sweetgum Loblolly pine Water oak	86 90 95 90	Loblolly pine, yellow-poplar, sweetgum.
LoD Loring	3r	Moderate	Moderate	Slight	Severe	Cherrybark oak Sweetgum Loblolly pine Water oak	86 90 95 82	Loblolly pine, yellow-poplar, sweetgum, shortleaf pine.
LoD3 Loring	4r	Moderate	Moderate	Slight	Moderate	Loblolly pine Water oak	85 82	Loblolly pine, shortleaf pine, Virginia pine, red cedar.
MaE* Markland	2c	Moderate	Moderate	Moderate	Moderate	White oak Northern red oak	75 75	Eastern white pine, red pine, yellow-poplar, white ash.
Mc McGary	2w	Slight	Moderate	Severe	Moderate	Pin oak Sweetgum White oak	85 90 75	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
Me Melvin	1w	Slight	Severe	Severe	Severe	Pin oak	101	Pin oak, American sycamore, sweetgum, loblolly pine.
MmB, MmC Memphis	2o	Slight	Slight	Slight	Moderate	Cherrybark oak Loblolly pine Sweetgum Water oak	90 90 90 90	Cherrybark oak, loblolly pine, sweetgum, yellow-poplar, black locust, black walnut.
Ne Newark	1w	Slight	Moderate	Slight	Severe	Pin oak Eastern cottonwood Northern red oak Yellow-poplar Sweetgum	99 94 85 95 88	Eastern cottonwood, sweetgum, post oak, loblolly pine, red maple, American sycamore, eastern white pine, yellow-poplar.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Nh: Nolin	1o	Slight	Slight	Slight	Severe	Sweetgum	85	Sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, white ash, cherrybark oak.
Nm*:								
Nolin	2r	Moderate	Severe	Moderate	Moderate	Sweetgum	85	Sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, white ash, cherrybark oak.
Melvin	1w	Slight	Severe	Severe	Severe	Pin oak	101	Pin oak, American sycamore, sweetgum, loblolly pine.
OtA, OtB: Otwell	3o	Slight	Slight	Slight	Slight	White oak	72	Eastern white pine, red pine, yellow-poplar, white ash.
SaA, SaB: Sadler	3o	Slight	Slight	Slight	Moderate	Northern red oak Yellow-poplar Virginia pine	70 90 70	Eastern white pine, shortleaf pine, yellow-poplar, Virginia pine.
Vc: Vicksburg	1o	Slight	Slight	Slight	Moderate	Cherrybark oak Eastern cottonwood Green ash Loblolly pine Nuttall oak Sweetgum	110 110 90 90 100 100	American sycamore, eastern cottonwood, green ash, loblolly pine, sweetgum, yellow-poplar.
Wa: Waverly	1w	Slight	Severe	Severe	Moderate	Eastern cottonwood Cherrybark oak Nuttall oak Water oak Willow oak Loblolly pine Sweetgum	105 100 100 95 95 95 100	Eastern cottonwood, cherrybark oak, water oak, willow oak, sweetgum, American sycamore, loblolly pine.
We: Weinbach	2w	Slight	Moderate	Moderate	Moderate	White oak Pin oak Yellow-poplar Sweetgum	75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
WlB, WlC, WlC3: Wellston	2o	Slight	Slight	Slight	Moderate	Northern red oak Yellow-poplar Virginia pine	71 90 70	Eastern white pine, black walnut, yellow-poplar.
WlD--(north aspect): Wellston	2r	Moderate	Moderate	Slight	Moderate	Northern red oak Yellow-poplar Virginia pine	81 97 76	Eastern white pine, black walnut, yellow-poplar.
WlD--(south aspect): Wellston	3r	Moderate	Moderate	Moderate	Moderate	Northern red oak Yellow-poplar Virginia pine	70 85 66	Eastern white pine, Virginia pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
W1D3-(north aspect) Wellston	2r	Moderate	Moderate	Slight	Moderate	Northern red oak---- Yellow-poplar-------- Virginia pine--------	81 97 76	Eastern white pine, black walnut, yellow-poplar.
W1D3-(south aspect) Wellston	3r	Moderate	Moderate	Moderate	Moderate	Northern red oak---- Yellow-poplar-------- Virginia pine--------	70 85 66	Eastern white pine, Virginia pine.
W1E--(north aspect) Wellston	2r	Moderate	Moderate	Slight	Moderate	Northern red oak---- Yellow-poplar-------- Virginia pine--------	81 97 76	Eastern white pine, black walnut, yellow-poplar.
W1E--(south aspect) Wellston	3r	Moderate	Moderate	Moderate	Moderate	Northern red oak---- Yellow-poplar-------- Virginia pine--------	70 85 66	Eastern white pine, Virginia pine.
ZaB, ZaC------------ Zanesville	3o	Slight	Slight	Slight	Moderate	Northern red oak---- Virginia pine--------	68 70	Virginia pine, eastern white pine, shortleaf pine.
ZaC3---------------- Zanesville	4d	Slight	Slight	Moderate	Slight	Northern red oak---- Virginia pine--------	60 70	Virginia pine, shortleaf pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Be------------------ Belknap	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Ca------------------ Calloway	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, corrosive.	Moderate: wetness, low strength.
CcC----------------- Caneyville	Severe: depth to rock.	Moderate: slope, depth to rock, low strength.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, low strength.
CcD----------------- Caneyville	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
CdE*:					
Caneyville---------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Rock outcrop.					
Cg------------------ Clifty	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Co------------------ Collins	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.
Du*. Dumps					
ElB----------------- Elk	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
ElC----------------- Elk	Moderate: slope, floods.	Severe: floods.	Severe: floods.	Severe: slope, floods.	Moderate: slope, floods.
FlD*, FlE*, FlF*:					
Frondorf----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lenberg-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GrA, GrB----------- Grenada	Moderate: wetness.	Moderate: wetness, low strength.	Moderate: wetness, low strength.	Moderate: corrosive, wetness, low strength.	Moderate: low strength, wetness.
He------------------ Henshaw	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Moderate: low strength, floods, wetness.
Ko, Ks------------- Karnak	Severe: floods, too clayey, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ld----------------- Lindside	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.
LoB----------------- Loring	Moderate: low strength, wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: slope, low strength.	Moderate: low strength.
LoC, LoC3---------- Loring	Moderate: slope, wetness, low strength.	Moderate: slope, low strength.	Moderate: slope, low strength, wetness.	Severe: slope.	Moderate: slope, low strength.
LoD, LoD3---------- Loring	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MaE*---------------- Markland	Severe: slope, too clayey, floods.	Severe: shrink-swell, slope, low strength, floods.	Severe: shrink-swell, slope, low strength, floods.	Severe: shrink-swell, low strength, floods, slope.	Severe: shrink-swell, low strength, slope, floods.
Mc----------------- McGary	Severe: too clayey, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, shrink-swell.
Me----------------- Melvin	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
MmB----------------- Memphis	Slight------------	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.
MmC----------------- Memphis	Moderate: slope.	Moderate: low strength, slope.	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope.
Ne----------------- Newark	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Nh----------------- Nolin	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Nm*:					
Nolin--------------	Severe: floods, slope.	Severe: floods, slope.	Severe: floods, slope.	Severe: floods, slope.	Severe: floods, slope.
Melvin-------------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
OtA, OtB----------- Otwell	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.
Pt*. Pits					
SaA, SaB----------- Sadler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: low strength.
Ud*. Udorthents					

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Vc: Vicksburg	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Wa, Wd: Waverly	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.
We: Weinbach	Severe: wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Moderate: low strength, wetness.
WlB: Wellston	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
WlC, WlC3: Wellston	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, low strength.
WlD, WlD3, WlE: Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ZaB: Zanesville	Moderate: wetness, depth to rock.	Moderate: wetness.	Moderate: depth to rock, wetness.	Moderate: slope, wetness.	Moderate: low strength.
ZaC, ZaC3: Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Moderate: slope, wetness, depth to rock.	Severe: slope.	Moderate: slope, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated.]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Be: Belknap	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Good.
Ca: Calloway	Severe: percs slowly, wetness.	Slight	Severe: wetness, percs slowly.	Moderate: wetness.	Good.
CcC: Caneyville	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: too clayey.
CcD: Caneyville	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, too clayey.
CdE*:					
Caneyville	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope, too clayey.
Rock outcrop.					
Cg: Clifty	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: small stones.
Co: Collins	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Good.
Du*. Dumps					
ElB: Elk	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
ElC: Elk	Moderate: slope, floods.	Severe: slope, floods.	Moderate: floods.	Moderate: slope, floods.	Fair: slope.
FlD*:					
Frondorf	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, thin layer.
Lenberg	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope.
FlE*, FlF*:					
Frondorf	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer.
Lenberg	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GrA------------------- Grenada	Severe: percs slowly.	Slight------------	Moderate: wetness.	Moderate: wetness.	Good.
GrB------------------- Grenada	Severe: percs slowly.	Moderate: slope.	Moderate: wetness.	Moderate: wetness.	Good.
He-------------------- Henshaw	Severe: wetness, percs slowly.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Good.
Ko, Ks---------------- Karnak	Severe: percs slowly, floods, wetness.	Severe: floods, wetness.	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Poor: wetness, too clayey.
Ld-------------------- Lindside	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
LoB------------------- Loring	Severe: percs slowly.	Moderate: slope.	Slight------------	Slight------------	Good.
LoC, LoC3------------- Loring	Severe: percs slowly.	Severe: slope.	Slight------------	Moderate: slope.	Fair: slope.
LoD, LoD3------------- Loring	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
MaE*------------------ Markland	Severe: percs slowly, slope, floods.	Severe: slope, floods.	Severe: too clayey, floods.	Severe: slope, floods.	Poor: too clayey, slope.
Mc-------------------- McGary	Severe: wetness, percs slowly.	Severe: floods.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
Me-------------------- Melvin	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
MmB------------------- Memphis	Slight------------	Moderate: seepage, slope.	Slight------------	Slight------------	Good.
MmC------------------- Memphis	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.	Fair: slope.
Ne-------------------- Newark	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Nh-------------------- Nolin	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Nm*:					
Nolin-----------------	Severe: floods, slope.	Severe: floods, slope.	Severe: floods, slope.	Severe: floods, slope.	Poor: slope.
Melvin----------------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
OtA, OtB-------------- Otwell	Severe: percs slowly.	Severe: floods.	Moderate: floods, wetness.	Moderate: floods.	Good.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pt*. Pits					
SaA: Sadler	Severe: percs slowly, wetness.	Moderate: depth to rock.	Severe: depth to rock.	Severe: wetness.	Good.
SaB: Sadler	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: wetness.	Good.
Ud*. Udorthents					
Vc: Vicksburg	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Good.
Wa, Wd: Waverly	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
We: Weinbach	Severe: wetness, percs slowly.	Severe: floods.	Severe: wetness.	Severe: wetness.	Good.
WlB: Wellston	Moderate: depth to rock.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight	Good.
WlC, WlC3: Wellston	Moderate: depth to rock, slope.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope.
WlD, WlD3: Wellston	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
WlE: Wellston	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
ZaB: Zanesville	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: depth to rock, wetness.	Moderate: wetness.	Good.
ZaC, ZaC3: Zanesville	Severe: percs slowly, wetness.	Severe: slope.	Severe: depth to rock.	Moderate: slope, wetness.	Fair: slope.

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms used that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Be------ Belknap	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ca------ Calloway	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CcC------ Caneyville	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
CcD------ Caneyville	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
CdE*:				
Caneyville------	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
Rock outcrop.				
Cg------ Clifty	Fair: low strength.	Poor: excess fines, small stones.	Poor: excess fines.	Poor: small stones.
Co------ Collins	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Du*. Dumps				
ElB------ Elk	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
ElC------ Elk	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
FlD*:				
Frondorf------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Lenberg------	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
FlE*, FlF*:				
Frondorf------	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Lenberg------	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
GrA, GrB------ Grenada	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
He------ Henshaw	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ko, Ks------------------ Karnak	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Ld--------------------- Lindside	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
LoB-------------------- Loring	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
LoC, LoC3-------------- Loring	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
LoD, LoD3-------------- Loring	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
MaE*------------------- Markland	Poor: shrink-swell, low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, slope, too clayey.
Mc--------------------- McGary	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Me--------------------- Melvin	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
MmB-------------------- Memphis	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
MmC-------------------- Memphis	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Ne--------------------- Newark	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Nh--------------------- Nolin	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Nm*:				
Nolin------------------	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Melvin-----------------	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
OtA, OtB--------------- Otwell	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Pt*. Pits				
SaA, SaB--------------- Sadler	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ud*. Udorthents				
Vc--------------------- Vicksburg	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Wa, Wd----------------- Waverly	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
We: Weinbach	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
WlB: Wellston	Fair: low strength.	Unsuited: excess fines.	Unsuited excess fines.	Good.
WlC, WlC3: Wellston	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
WlD, WlD3: Wellston	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
WlE: Wellston	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
ZaB: Zanesville	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
ZaC, ZaC3: Zanesville	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Be: Belknap	Seepage	Hard to pack, piping.	Floods	Not needed	Erodes easily.
Ca: Calloway	Favorable	Piping, compressible, low strength.	Cutbanks cave, percs slowly, slope.	Percs slowly, erodes easily, piping.	Percs slowly, erodes easily, slope.
CcC, CcD: Caneyville	Depth to rock	Thin layer, hard to pack.	Not needed	Depth to rock, slope, erodes easily.	Slope, erodes easily, depth to rock.
CdE*:					
Caneyville	Depth to rock	Thin layer, hard to pack.	Not needed	Depth to rock, slope, erodes easily.	Slope, erodes easily, depth to rock.
Rock outcrop.					
Cg: Clifty	Seepage	Seepage, piping.	Not needed	Not needed	Favorable.
Co: Collins	Seepage	Piping, unstable fill.	Cutbanks cave, floods.	Not needed	Erodes easily.
Du*. Dumps					
ElB, ElC: Elk	Seepage	Low strength, piping.	Not needed	Slope	Slope.
FlD*, FlE*, FlF*:					
Frondorf	Seepage, depth to rock.	Thin layer, piping.	Not needed	Depth to rock, slope.	Slope, depth to rock.
Lenberg	Depth to rock	Hard to pack, shrink-swell.	Not needed	Slope, erodes easily, depth to rock.	Slope, erodes easily, depth to rock.
GrA, GrB: Grenada	Favorable	Piping, low strength.	Not needed	Erodes easily, slope.	Erodes easily, slope.
He: Henshaw	Favorable	Wetness	Favorable	Wetness	Wetness.
Ko, Ks: Karnak	Favorable	Compressible, low strength, shrink-swell.	Poor outlets, percs slowly, wetness.	Not needed	Not needed.
Ld: Lindside	Seepage	Piping, low strength, compressible.	Floods	Not needed	Wetness.
LoB, LoC, LoC3, LoD, LoD3: Loring	Seepage	Piping, low strength.	Not needed	Erodes easily, slope.	Rooting depth, erodes easily, slope.
MaE*: Markland	Favorable	Low strength, compressible, shrink-swell.	Not needed	Complex slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Mc: McGary	Favorable	Shrink-swell, low strength, compressible.	Percs slowly	Percs slowly, wetness.	Percs slowly, wetness.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Me----------------- Melvin	Seepage------------	Wetness------------	Wetness, floods.	Not needed--------	Wetness, erodes easily.
MmB, MmC----------- Memphis	Seepage------------	Piping, compressible, erodes easily.	Not needed--------	Erodes easily, slope, piping.	Erodes easily, slope.
Ne----------------- Newark	Seepage------------	Low strength, piping.	Wetness, floods, poor outlets.	Not needed--------	Wetness.
Nh----------------- Nolin	Seepage------------	Piping, low strength.	Not needed--------	Not needed--------	Not needed.
Nm*:					
Nolin--------------	Seepage------------	Piping, low strength.	Not needed--------	Slope--------------	Slope.
Melvin-------------	Seepage------------	Wetness------------	Wetness, floods.	Not needed--------	Wetness, erodes easily.
OtA, OtB----------- Otwell	Favorable----------	Low strength-------	Not needed--------	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Pt*. Pits					
SaA, SaB----------- Sadler	Depth to rock, seepage, slope.	Compressible, hard to pack, piping.	Percs slowly, wetness, slope.	Percs slowly, wetness, erodes easily.	Percs slowly, erodes easily, wetness.
Ud*. Udorthents					
Vc----------------- Vicksburg	Seepage------------	Piping, low strength.	Floods-------------	Not needed--------	Erodes easily.
Wa, Wd------------- Waverly	Seepage------------	Compressible, piping.	Wetness, floods.	Not needed--------	Wetness.
We----------------- Weinbach	Favorable----------	Low strength-------	Percs slowly, wetness.	Not needed--------	Not needed.
WlB---------------- Wellston	Seepage, depth to rock.	Piping, hard to pack, erodes easily.	Not needed--------	Slope--------------	Erodes easily, slope.
WlC, WlC3, WlD, WlD3, WlE--------- Wellston	Seepage, depth to rock.	Piping, hard to pack, erodes easily.	Not needed--------	Slope--------------	Erodes easily, slope.
ZaB, ZaC, ZaC3----- Zanesville	Depth to rock, seepage.	Piping, thin layer.	Percs slowly, slope.	Percs slowly, wetness.	Percs slowly, erodes easily, wetness.

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Be-------- Belknap	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: wetness.	Moderate: wetness.
Ca-------- Calloway	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
CcC-------- Caneyville	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
CcD-------- Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
CdE*:				
Caneyville--------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Rock outcrop.				
Cg-------- Clifty	Severe: floods.	Moderate: floods, small stones.	Severe: floods, small stones.	Moderate: small stones.
Co-------- Collins	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Du*. Dumps				
ElB-------- Elk	Severe: floods.	Slight--------	Moderate: slope.	Slight.
ElC-------- Elk	Severe: floods.	Moderate: slope.	Severe: slope.	Slight.
FlD*:				
Frondorf--------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Lenberg--------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
FlE*, FlF*:				
Frondorf--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lenberg--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GrA, GrB-------- Grenada	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
He-------- Henshaw	Severe: floods.	Moderate: wetness.	Moderate: wetness, percs slowly.	Moderate: wetness.
Ko, Ks-------- Karnak	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ld: Lindside	Severe: floods.	Moderate: floods, wetness.	Moderate: floods, wetness.	Slight.
LoB: Loring	Slight	Slight	Moderate: slope.	Slight.
LoC, LoC3: Loring	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
LoD, LoD3: Loring	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
MaE*: Markland	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Mc: McGary	Severe: floods, wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
Me: Melvin	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
MmB: Memphis	Slight	Slight	Moderate: slope.	Slight.
MmC: Memphis	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ne: Newark	Severe: floods, wetness.	Moderate: floods, wetness.	Moderate: floods, wetness.	Moderate: wetness.
Nh: Nolin	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Nm*:				
Nolin	Severe: floods, slope.	Severe: slope.	Severe: floods, slope.	Moderate: slope.
Melvin	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
OtA, OtB: Otwell	Severe: floods, percs slowly.	Slight	Moderate: percs slowly.	Slight.
Pt*. Pits				
SaA: Sadler	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
SaB: Sadler	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Ud*. Udorthents				
Vc: Vicksburg	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Wa, Wd----------------- Waverly	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
We--------------------- Weinbach	Severe: floods, percs slowly, wetness.	Moderate: wetness, floods.	Moderate: percs slowly, wetness.	Moderate: wetness.
WlB-------------------- Wellston	Slight----------------	Slight----------------	Moderate: slope.	Slight.
WlC, WlC3-------------- Wellston	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
WlD, WlD3-------------- Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
WlE-------------------- Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ZaB-------------------- Zanesville	Moderate: percs slowly.	Slight----------------	Moderate: slope, percs slowly.	Slight.
ZaC, ZaC3-------------- Zanesville	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Be----------------- Belknap	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
Ca----------------- Calloway	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
CcC---------------- Caneyville	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
CcD---------------- Caneyville	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
CdE*:										
Caneyville---------	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Rock outcrop.										
Cg----------------- Clifty	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Co----------------- Collins	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
Du*. Dumps										
ElB---------------- Elk	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
ElC---------------- Elk	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
FlD*:										
Frondorf-----------	Poor	Good	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Lenberg------------	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
FlE*:										
Frondorf-----------	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Lenberg------------	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
FlF*:										
Frondorf-----------	Very poor	Poor	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor
Lenberg------------	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
GrA, GrB----------- Grenada	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
He----------------- Henshaw	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
Ko, Ks------------- Karnak	Poor	Fair	Fair	Fair	Fair	Poor	Good	Fair	Fair	Fair

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ld------------------ Lindside	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
LoB----------------- Loring	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
LoC, LoC3----------- Loring	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
LoD, LoD3----------- Loring	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
MaE*---------------- Markland	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Mc------------------ McGary	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
Me------------------ Melvin	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good
MmB----------------- Memphis	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
MmC----------------- Memphis	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
Ne------------------ Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair
Nh------------------ Nolin	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Nm*:										
Nolin---------------	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
Melvin--------------	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good
OtA, OtB------------ Otwell	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Pt*. Pits										
SaA----------------- Sadler	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
SaB----------------- Sadler	Fair	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Ud*. Udorthents										
Vc------------------ Vicksburg	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
Wa------------------ Waverly	Poor	Fair	Good	Fair	Fair	Good	Fair	Fair	Fair	Fair
Wd------------------ Waverly	Very poor	Very poor	Very poor	Very poor	Very poor	Good	Fair	Very poor	Very poor	Fair

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
We-------------------- Weinbach	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
WlB------------------ Wellston	Fair	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
WlC, WlC3------------ Wellston	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
WlD, WlD3------------ Wellston	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
WlE------------------ Wellston	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor
ZaB------------------ Zanesville	Fair	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor
ZaC, ZaC3------------ Zanesville	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Be----------------- Belknap	0-8	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	80-100	21-29	2-8
	8-60	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-100	22-32	NP-10
Ca----------------- Calloway	0-24	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	90-100	25-35	5-15
	24-65	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	90-100	25-35	5-15
CcC, CcD----------- Caneyville	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	5-12	Silty clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	12-30	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CdE*: Caneyville---------	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	5-12	Silty clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	12-30	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Cg----------------- Clifty	0-8	Gravelly silt loam.	ML, CL-ML, GM, GM-GC	A-4	0-10	65-85	60-80	55-75	45-70	20-35	2-10
	8-26	Gravelly silt loam, gravelly loam.	ML, CL-ML, GM, GM-GC	A-4	0-15	55-75	50-70	45-65	35-60	20-35	2-10
	26-60	Gravelly silt loam, very gravelly loam.	GM, GM-GC, SM	A-2, A-4, A-1	0-25	40-75	35-70	25-60	15-50	<30	NP-7
Co----------------- Collins	0-9	Silt loam--------	ML, CL-ML	A-4	0	100	100	85-100	70-95	25-35	4-10
	9-60	Silt loam, loam	ML, CL-ML	A-4	0	100	100	90-100	70-95	<35	NP-10
Du*. Dumps											
ElB, ElC----------- Elk	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	70-95	25-35	3-10
	9-50	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
	50-60	Silty clay loam, silt loam, loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	0	75-100	50-100	45-100	40-95	25-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FlD*:											
Frondorf	0-20	Silt loam	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	20-32	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2	10-40	55-90	50-85	40-80	30-75	<40	NP-20
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Lenberg	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6	0-15	75-100	75-100	75-95	56-90	25-35	4-12
	4-18	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0-15	75-100	75-100	75-95	60-90	35-70	15-40
	18-25	Silty clay, clay	CL, CH	A-7	0-15	75-100	75-100	75-95	60-90	45-70	20-40
	25-35	Very gravelly silty clay, clay, silty clay.	CL, CH, SC, GC	A-7	5-40	60-95	40-95	40-95	36-90	45-70	20-40
	35	Weathered bedrock.	---	---	---	---	---	---	---	---	---
FlE*, FlF*:											
Frondorf	0-20	Silt loam	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	20-32	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2.	10-40	55-90	50-85	40-80	30-75	<40	NP-20
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Lenberg	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6	0-15	75-100	75-100	75-95	56-90	25-35	4-12
	4-18	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0-15	75-100	75-100	75-95	60-90	35-70	15-40
	18-25	Silty clay, clay	CL, CH	A-7	0-15	75-100	75-100	75-95	60-90	45-70	20-40
	25-35	Very gravelly silty clay, clay, silty clay.	CL, CH, SC, GC	A-7	5-40	60-95	40-95	40-95	36-90	45-70	20-40
	35	Weathered bedrock.	---	---	---	---	---	---	---	---	---
GrA, GrB-- Grenada	0-8	Silt loam	ML, CL-ML	A-4	0	100	100	100	90-100	<30	NP-6
	8-28	Silt loam, silty clay loam.	CL, ML, CL-ML	A-6, A-4	0	100	100	100	90-100	25-40	2-15
	28-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	90-100	25-40	13-24
He-- Henshaw	0-8	Silt loam	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	25-35	3-10
	8-48	Silty clay loam, silt loam.	CL, ML	A-6, A-4	0	95-100	95-100	95-100	85-100	30-40	8-18
	48-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
Ko-- Karnak	0-10	Silt loam	CL, ML,	A-4, A-6	0	100	100	95-100	95-100	30-40	6-15
	10-60	Silty clay, clay	CH, MH, CL	A-7	0	100	100	95-100	95-100	45-80	23-38

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ks------------------ Karnak	0-8	Silty clay-------	CH, CL, MH	A-7	0	100	100	95-100	95-100	45-80	25-45
	8-60	Silty clay, clay	CH, MH, CL	A-7	0	100	100	95-100	95-100	45-80	23-38
Ld------------------ Lindside	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	85-100	60-95	25-40	2-25
	9-60	Silty clay loam to very fine sandy loam.	ML, CL	A-4, A-6	0	100	95-100	60-100	50-95	20-40	1-25
LoB, LoC------------ Loring	0-7	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	20-35	2-15
	7-33	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	30-40	10-25
	33-50	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-18
	50-64	Silt loam--------	CL, CL-ML.	A-4, A-6	0	100	100	95-100	90-100	25-40	6-15
LoC3---------------- Loring	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	20-35	4-15
	7-18	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	30-40	10-25
	18-35	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-18
	35-49	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-15
LoD----------------- Loring	0-7	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	20-35	2-15
	7-33	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	30-40	10-25
	33-50	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-18
	50-64	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-15
LoD3---------------- Loring	0-7	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	20-35	4-15
	7-18	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	30-40	10-25
	18-35	Silt loam-------- CL-ML	CL,	A-4, A-6	0	100	100	95-100	90-100	25-40	6-18
	35-49	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-15
MaE*---------------- Markland	0-3	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	3-42	Silty clay, clay	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	42-60	Clay, silty clay	CL, CH	A-7	0	100	100	90-100	75-95	45-60	20-35
Mc------------------ McGary	0-8	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-36	5-15
	8-45	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	46-65	24-35
	45-66	Silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	85-100	38-54	20-32

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Me----- Melvin	0-8	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	95-100	90-100	80-100	65-95	25-35	2-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	85-100	80-100	70-100	60-95	25-40	5-20
MmB, MmC----- Memphis	0-8	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	100	90-100	<30	NP-10
	8-36	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	100	90-100	25-40	5-20
	36-60	Silt loam-------	ML, CL-ML	A-4	0	100	100	100	90-100	25-35	4-10
Ne----- Newark	0-8	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-95	<35	NP-15
	8-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-95	25-40	5-20
Nh----- Nolin	0-10	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	2-18
	10-65	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	95-100	85-100	75-100	25-40	2-18
Nm*: Nolin-----	0-10	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	2-18
	10-65	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	95-100	85-100	75-100	25-40	2-18
Melvin-----	0-8	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	95-100	90-100	80-100	65-95	25-35	2-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	85-100	80-100	70-100	60-95	25-40	5-20
OtA----- Otwell	0-10	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-95	25-35	2-15
	10-27	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-20
	27-45	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	65-90	25-40	5-20
	45-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	80-95	25-40	5-20
OtB----- Otwell	0-10	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-95	25-35	2-15
	10-27	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-20
	27-45	Silty clay loam, silt loam.	CL,	A-4, A-6	0	95-100	95-100	85-100	65-90	25-40	5-20
	45-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	80-95	25-40	5-20
Pt*. Pits											
SaA----- Sadler	0-7	Silt loam-------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-100	25-35	2-10
	7-25	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	75-100	25-40	2-20
	25-45	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-100	55-95	20-40	2-20
	45-60	Loam, silty clay loam, gravelly fine sandy loam	ML, CL, SM	A-4, A-6, A-7	0-20	65-100	60-95	50-95	35-90	20-50	2-30

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SaB----------------- Sadler	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-100	25-35	2-10
	7-25	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	75-100	25-40	2-20
	25-45	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-100	55-95	20-40	2-20
	45-60	Loam, silty clay loam, gravelly fine sandy loam	ML, CL, SM	A-4, A-6, A-7	0-20	65-100	60-95	50-95	35-90	20-50	2-30
Ud*. Udorthents											
Vc------------------ Vicksburg	0-60	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	70-100	<35	NP-10
Wa------------------ Waverly	0-10	Silt loam--------	ML, CL	A-4	0	95-100	95-100	90-100	75-95	<25	NP-9
	10-60	Silt loam--------	ML, CL	A-4	0	95-100	95-100	95-100	85-100	20-30	4-10
Wd------------------ Waverly	0-10	Silt loam--------	ML, CL	A-4	0	95-100	95-100	90-100	75-95	<25	NP-9
	10-60	Silt loam--------	ML, CL	A-4	0	95-100	95-100	95-100	85-100	20-30	4-10
We------------------ Weinbach	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	5-15
	8-26	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	70-90	25-35	8-15
	26-56	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	70-90	25-35	8-15
	56-70	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-95	30-40	8-15
WlB, WlC------------ Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-30	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	85-100	85-100	60-95	60-95	25-40	5-20
	30-52	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-80	20-35	5-15
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WlC3---------------- Wellston	0-8	Silt loam--------	ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-95	25-35	3-15
	8-22	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	85-100	85-100	60-95	60-90	25-40	5-20
	22-44	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-80	20-35	5-15
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WlD----------------- Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-30	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	85-100	85-100	60-95	60-90	25-40	5-20
	30-52	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-80	40-65	20-35	5-15
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WlD3---------------- Wellston	0-8	Silt loam--------	ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-95	25-35	3-15
	8-22	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	85-100	85-100	60-95	60-90	25-40	5-20
	22-44	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
WlE------------------ Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-30	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	85-100	85-100	60-95	60-95	25-40	5-20
	30-52	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-80	40-65	20-35	5-15
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaB------------------ Zanesville	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	30-40	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	40-70	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaC------------------ Zanesville	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	30-40	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	40-70	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaC3----------------- Zanesville	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-15	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	15-25	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	25-55	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater then. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Be. Belknap	0-8	0.6-2.0	0.22-0.24	4.5-6.5	Low	High	High	0.43	5
	8-60	0.6-2.0	0.20-0.22	4.5-5.5	Low	High	High	0.43	
Ca. Calloway	0-24	0.6-2.0	0.20-0.23	4.5-6.5	Low	High	Moderate	0.49	3
	24-65	0.06-0.2	0.09-0.12	4.5-5.5	Low	High	Moderate	0.43	
CcC, CcD. Caneyville	0-5	0.6-2.0	0.15-0.22	4.5-6.0	Low	Moderate	Moderate	0.43	3
	5-12	0.2-0.6	0.12-0.18	4.5-6.0	Moderate	High	Moderate	0.28	
	12-30	0.2-0.6	0.12-0.18	5.6-7.3	Moderate	High	Moderate	0.28	
	30	---	---	---	---	---	---	---	
CdE*:									
Caneyville	0-5	0.6-2.0	0.15-0.22	4.5-6.0	Low	Moderate	Moderate	0.43	3
	5-12	0.2-0.6	0.12-0.18	4.5-6.0	Moderate	High	Moderate	0.28	
	12-30	0.2-0.6	0.12-0.18	5.6-7.3	Moderate	High	Moderate	0.28	
	30	---	---	---	---	---	---	---	
Rock outcrop.									
Cg. Clifty	0-8	2.0-6.0	0.10-0.18	4.5-6.0	Low	Low	High	0.28	5
	8-26	2.0-6.0	0.08-0.16	4.5-5.5	Low	Low	High	0.28	
	26-60	2.0-20	0.05-0.12	4.5-5.5	Low	Low	High	0.28	
Co. Collins	0-9	0.6-2.0	0.16-0.24	4.5-5.5	Low	Moderate	Moderate	0.43	5
	9-60	0.6-2.0	0.20-0.24	4.5-5.5	Low	Moderate	Moderate	0.43	
Du*. Dumps									
ElB, ElC. Elk	0-9	0.6-2.0	0.19-0.23	4.5-6.5	Low	Moderate	Moderate	0.32	4
	9-50	0.6-2.0	0.18-0.22	4.5-5.5	Low	Moderate	Moderate	0.28	
	50-60	0.6-2.0	0.14-0.20	4.5-5.5	Low	Moderate	Moderate	0.28	
FlD*:									
Frondorf	0-20	0.6-2.0	0.18-0.22	4.5-5.5	Low	Moderate	High	0.32	3
	20-32	0.6-2.0	0.08-0.16	4.5-5.5	Low	Moderate	High	0.17	
	32	---	---	---	---	---	---	---	
Lenberg	0-4	0.6-2.0	0.18-0.23	4.5-5.5	Low	Moderate	Moderate	0.43	3
	4-18	0.2-0.6	0.17-0.19	4.5-5.5	Moderate	Moderate	Moderate	0.37	
	18-25	0.2-0.6	0.11-0.18	4.5-5.5	Moderate	Moderate	Moderate	0.37	
	25-35	0.2-0.6	0.05-0.07	4.5-5.5	Moderate	Moderate	Moderate	0.28	
	35	---	---	---	---	---	---	---	
FlE*, FlF*:									
Frondorf	0-20	0.6-2.0	0.18-0.22	4.5-5.5	Low	Moderate	High	0.32	3
	20-32	0.6-2.0	0.08-0.16	4.5-5.5	Low	Moderate	High	0.17	
	32	---	---	---	---	---	---	---	
Lenberg	0-4	0.6-2.0	0.18-0.23	4.5-5.5	Low	Moderate	Moderate	0.43	3
	4-18	0.2-0.6	0.17-0.19	4.5-5.5	Moderate	Moderate	Moderate	0.37	
	18-25	0.2-0.6	0.11-0.18	4.5-5.5	Moderate	Moderate	Moderate	0.37	
	25-35	0.2-0.6	0.05-0.07	4.5-5.5	Moderate	Moderate	Moderate	0.28	
	35	---	---	---	---	---	---	---	
GrA, GrB. Grenada	0-8	0.6-2.0	0.20-0.23	4.5-6.0	Low	Moderate	Moderate	0.43	3
	8-28	0.6-2.0	0.17-0.20	4.5-6.0	Low	Moderate	Moderate	0.43	
	28-43	0.06-0.2	0.10-0.12	4.5-6.0	Low	Moderate	Moderate	0.37	
	43-60	0.06-0.2	0.10-0.12	4.5-6.0	Low	Moderate	Moderate	0.37	
He. Henshaw	0-8	0.6-2.0	0.18-0.23	5.1-6.5	Low	High	Moderate	0.43	4
	8-48	0.2-0.6	0.15-0.19	5.1-7.3	Low	High	Moderate	0.43	
	48-60	0.2-0.6	0.17-0.22	6.6-8.4	Low	High	Low	0.43	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Ko, Ks--------------	0-8	0.06-0.2	0.11-0.14	5.1-6.5	Moderate------	High------	Moderate	0.43	3
Karnak	8-60	<0.2	0.13-0.17	5.1-7.8	High----------	High------	Moderate	0.43	
Ld------------------	0-9	0.6-2.0	0.18-0.26	5.6-6.5	Low-----------	Moderate	Low-------	0.43	5
Lindside	9-60	0.2-2.0	0.12-0.18	5.6-6.5	Low-----------	Moderate	Moderate	0.43	
LoB, LoC------------	0-7	0.6-2.0	0.20-0.23	4.5-6.5	Low-----------	Moderate	Moderate	0.43	3
Loring	7-33	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	33-50	0.2-0.6	0.06-0.13	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	50-64	0.6-2.0	0.06-0.13	4.5-5.5	Low-----------	Moderate	Low-------	0.43	
LoC3----------------	0-7	0.6-2.0	0.20-0.23	4.5-6.5	Low-----------	Moderate	Moderate	0.43	3
Loring	7-18	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	18-35	0.2-0.6	0.06-0.13	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	35-49	0.6-2.0	0.06-0.13	4.5-5.5	Low-----------	Moderate	Low-------	0.43	
LoD-----------------	0-7	0.6-2.0	0.20-0.23	4.5-6.5	Low-----------	Moderate	Moderate	0.43	3
Loring	7-33	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	33-50	0.2-0.6	0.06-0.13	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	50-64	0.6-2.0	0.06-0.13	4.5-5.5	Low-----------	Moderate	Low-------	0.43	
LoD3----------------	0-7	0.6-2.0	0.20-0.23	4.5-6.5	Low-----------	Moderate	Moderate	0.43	3
Loring	7-18	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	18-35	0.2-0.6	0.06-0.13	4.5-5.5	Low-----------	Moderate	Moderate	0.43	
	35-49	0.6-2.0	0.06-0.13	4.5-5.5	Low-----------	Moderate	Low-------	0.43	
MaE*----------------	0-3	0.6-2.0	0.22-0.24	5.1-6.0	Low-----------	Low-------	Moderate	0.43	3
Markland	3-42	0.06-0.2	0.11-0.13	5.1-7.8	High----------	High------	Moderate	0.32	
	42-60	0.06-0.2	0.09-0.11	6.6-8.4	High----------	High------	Low-------	0.32	
Mc------------------	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	Moderate	Low-------	0.49	3
McGary	8-45	<0.2	0.11-0.13	5.1-7.3	High----------	High------	Low-------	0.32	
	45-66	<0.2	0.14-0.16	6.6-7.8	High----------	High------	Low-------	0.32	
Me------------------	0-8	0.6-2.0	0.18-0.23	5.6-7.8	Low-----------	High------	Low-------	0.43	5
Melvin	8-60	0.6-2.0	0.18-0.23	5.6-7.8	Low-----------	High------	Low-------	0.43	
MmB, MmC------------	0-8	0.6-2.0	0.20-0.23	4.5-6.0	Low-----------	Low-------	Moderate	0.37	5
Memphis	8-36	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	Moderate	Moderate	0.37	
	36-60	0.6-2.0	0.20-0.23	4.5-6.0	Low-----------	Low-------	Moderate	0.37	
Ne------------------	0-8	0.6-2.0	0.15-0.23	5.6-7.3	Low-----------	High------	Low-------	0.43	5
Newark	8-60	0.6-2.0	0.18-0.23	5.6-7.3	Low-----------	High------	Low-------	0.43	
Nh------------------	0-10	0.6-2.0	0.18-0.23	5.6-7.3	Low-----------	Low-------	Moderate	0.43	5
Nolin	10-65	0.6-2.0	0.18-0.23	5.6-7.3	Low-----------	Low-------	Moderate	0.43	
Nm*:									
Nolin---------------	0-10	0.6-2.0	0.18-0.23	5.6-7.3	Low-----------	Low-------	Moderate	0.43	5
	10-65	0.6-2.0	0.18-0.23	5.6-7.3	Low-----------	Low-------	Moderate	0.43	
Melvin--------------	0-8	0.6-2.0	0.18-0.23	5.6-7.8	Low-----------	High------	Low-------	0.43	5
	8-60	0.6-2.0	0.18-0.23	5.6-7.8	Low-----------	High------	Low-------	0.43	
OtA-----------------	0-10	0.6-2.0	0.18-0.22	4.5-5.5	Low-----------	Moderate	High------	0.43	3
Otwell	10-27	0.6-2.0	0.17-0.19	4.5-5.5	Low-----------	Moderate	High------	0.43	
	27-45	0.06-0.2	0.06-0.08	4.5-5.5	Low-----------	Moderate	High------	0.43	
	45-60	0.06-0.2	0.06-0.08	4.5-5.5	Low-----------	Moderate	High------	0.43	
OtB-----------------	0-10	0.6-2.0	0.18-0.22	4.5-5.5	Low-----------	Moderate	High------	0.43	3
Otwell	10-27	0.6-2.0	0.17-0.19	4.5-5.5	Low-----------	Moderate	High------	0.43	
	27-45	0.06-0.2	0.06-0.08	4.5-5.5	Low-----------	Moderate	High------	0.43	
	45-60	0.06-0.2	0.06-0.08	4.5-5.5	Low-----------	Moderate	High------	0.43	
Pt*.									
Pits									

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
SaA----------------- Sadler	0-7	0.6-2.0	0.19-0.23	4.5-6.5	Low------------	Moderate	High------	0.43	3
	7-25	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	Moderate	High------	0.43	
	25-45	0.06-0.2	0.07-0.12	4.5-5.5	Low------------	Moderate	High------	0.43	
	45-60	0.2-2.0	0.07-0.12	4.5-5.5	Low------------	Moderate	High------	0.43	
SaB----------------- Sadler	0-7	0.6-2.0	0.19-0.23	4.5-6.5	Low------------	Moderate	High------	0.43	3
	7-25	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	Moderate	High------	0.43	
	25-45	0.06-0.2	0.07-0.12	4.5-5.5	Low------------	Moderate	High------	0.43	
	45-60	0.2-2.0	0.07-0.12	4.5-5.5	Low------------	Moderate	High------	0.43	
Ud*. Udorthents									
Vc----------------- Vicksburg	0-60	0.6-2.0	0.20-0.24	4.5-5.5	Low------------	Low--------	Moderate	0.43	5
Wa----------------- Waverly	0-10	0.6-2.0	0.20-0.22	4.5-6.5	Low------------	High------	Moderate	0.43	3
	10-60	0.6-2.0	0.20-0.22	4.5-5.5	Low------------	High------	Moderate	0.43	
Wd----------------- Waverly	0-10	0.6-2.0	0.20-0.22	4.5-5.5	Low------------	High------	Moderate	0.43	3
	10-60	0.6-2.0	0.20-0.22	4.5-5.5	Low------------	High------	Moderate	0.43	
We----------------- Weinbach	0-8	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	High------	High------	0.43	3
	8-26	0.6-2.0	0.18-0.20	4.5-5.5	Low------------	High------	High------	0.43	
	26-56	<0.2	0.06-0.08	4.5-5.5	Low------------	High------	High------	0.43	
	56-70	<0.2	0.06-0.08	4.5-5.5	Low------------	High------	High------	0.43	
WlB, WlC----------- Wellston	0-8	0.6-2.0	0.18-0.22	4.5-6.5	Low------------	Moderate	Moderate	0.37	4
	8-30	0.6-2.0	0.17-0.21	4.5-5.5	Low------------	Moderate	High------	0.37	
	30-52	0.6-2.0	0.12-0.17	4.5-5.5	Low------------	Moderate	High------	0.37	
	52	---	---	---	--------------	----------	----------	---	
WlC3--------------- Wellston	0-8	0.6-2.0	0.18-0.22	4.5-6.5	Low------------	Moderate	Moderate	0.37	4
	8-22	0.6-2.0	0.17-0.21	4.5-5.5	Low------------	Moderate	High------	0.37	
	22-44	0.6-2.0	0.12-0.17	4.5-5.5	Low------------	Moderate	High------	0.37	
	44	---	---	---	--------------	----------	----------	---	
WlD---------------- Wellston	0-8	0.6-2.0	0.18-0.22	4.5-6.5	Low------------	Moderate	Moderate	0.37	4
	8-30	0.6-2.0	0.17-0.21	4.5-5.5	Low------------	Moderate	High------	0.37	
	30-52	0.6-2.0	0.12-0.17	4.5-5.5	Low------------	Moderate	High------	0.37	
	52	---	---	---	--------------	----------	----------	---	
WlD3--------------- Wellston	0-8	0.6-2.0	0.18-0.22	4.5-6.5	Low------------	Moderate	Moderate	0.37	4
	8-22	0.6-2.0	0.17-0.21	4.5-5.5	Low------------	Moderate	High------	0.37	
	22-44	0.6-2.0	0.12-0.17	4.5-5.5	Low------------	Moderate	High------	0.37	
	44	---	---	---	--------------	----------	----------	---	
WlE---------------- Wellston	0-8	0.6-2.0	0.18-0.22	4.5-6.5	Low------------	Moderate	Moderate	0.37	4
	8-30	0.6-2.0	0.17-0.21	4.5-5.5	Low------------	Moderate	High------	0.37	
	30-52	0.6-2.0	0.12-0.17	4.5-5.5	Low------------	Moderate	High------	0.37	
	52	---	---	---	--------------	----------	----------	---	
ZaB---------------- Zanesville	0-8	0.6-2.0	0.19-0.23	4.5-7.3	Low------------	Moderate	High------	0.37	3
	8-30	0.6-2.0	0.15-0.18	4.5-5.5	Low------------	Moderate	High------	0.37	
	30-40	0.06-0.6	0.08-0.12	4.5-5.5	Low------------	Moderate	High------	0.37	
	40-70	0.2-2.0	0.08-0.12	4.5-5.5	Low------------	Moderate	High------	0.28	
	70	---	---	---	--------------	----------	----------	---	
ZaC---------------- Zanesville	0-8	0.6-2.0	0.19-0.23	4.5-7.3	Low------------	Moderate	High------	0.37	3
	8-30	0.6-2.0	0.15-0.18	4.5-5.5	Low------------	Moderate	High------	0.37	
	30-40	0.06-0.6	0.08-0.12	4.5-5.5	Low------------	Moderate	High------	0.37	
	40-70	0.2-2.0	0.08-0.12	4.5-5.5	Low------------	Moderate	High------	0.28	
	70	---	---	---	--------------	----------	----------	---	
ZaC3--------------- Zanesville	0-8	0.6-2.0	0.19-0.23	4.5-7.3	Low------------	Moderate	High------	0.37	3
	8-15	0.6-2.0	0.15-0.18	4.5-5.5	Low------------	Moderate	High------	0.37	
	15-25	0.06-0.6	0.08-0.12	4.5-5.5	Low------------	Moderate	High------	0.37	
	25-55	0.2-2.0	0.08-0.12	4.5-5.5	Low------------	Moderate	High------	0.28	
	55	---	---	---	--------------	----------	----------	---	

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means greater than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Be----------------- Belknap	C	Common-------	Brief------	Jan-Apr	0.5-1.5	Apparent	Dec-Apr	>60	---
Ca----------------- Calloway	C	None---------	---	---	0.5-1.5	Perched	Dec-Apr	>60	---
CcC, CcD----------- Caneyville	C	None---------	---	---	>6.0	---	---	20-40	Hard
CdE*:									
Caneyville---------	C	None---------	---	---	>6.0	---	---	20-40	Hard
Rock outcrop.									
Cg----------------- Clifty	B	Common-------	Very brief	Jan-Apr	3.0-5.0	Apparent	Dec-Apr	>60	---
Co----------------- Collins	C	Common-------	Brief------	Jan-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---
Du*. Dumps									
ElB, ElC----------- Elk	B	Rare--------- occasional.	---	---	>6.0	---	---	>60	---
FlD*, FlE*, FlF*:									
Frondorf----------	B	None---------	---	---	>6.0	---	---	20-40	Rippable
Lenberg-----------	C	None---------	---	---	>6.0	---	---	20-40	Rippable
GrA, GrB----------- Grenada	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---
He----------------- Henshaw	C	Rare---------	---	---	1.0-2.0	Apparent	Dec-Apr	>60	---
Ko, Ks------------- Karnak	D	Common-------	Long-------	Jan-Apr	0.0-3.0	Apparent	Dec-May	>60	---
Ld----------------- Lindside	C	Common-------	Brief to long.	Jan-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---
LoB, LoC, LoC3, LoD, LoD3--------- Loring	C	None---------	---	---	2.5-3.0	Perched	Dec-Apr	>60	---
MaE*--------------- Markland	C	Common-------	Brief to long.	Jan-Apr	3.0-6.0	Perched	Dec-Apr	>60	---
Mc----------------- McGary	C	Rare---------	---	---	1.0-3.0	Apparent	Dec-Apr	>60	---
Me----------------- Melvin	D	Common-------	Brief to long.	Jan-Apr	0.0-1.0	Apparent	Dec-May	>60	---
MmB, MmC----------- Memphis	B	None---------	---	---	>6.0	---	---	>60	---
Ne----------------- Newark	C	Common-------	Brief to long.	Jan-Apr	0.5-1.5	Apparent	Dec-Apr	>60	---

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Nh----------------- Nolin	B	Common-------	Brief to-- long.	Jan-Apr	3.0-6.0	Apparent	Dec-Apr	>60	---
Nm*:									
Nolin-------------	B	Common-------	Brief to long.	Jan-Apr	3.0-6.0	Apparent	Dec-Apr	>60	---
Melvin------------	D	Common-------	Brief to long.	Jan-Apr	0.0-1.0	Apparent	Dec-May	>60	---
OtA, OtB----------- Otwell	C	Rare---------	---	---	2.0-3.5	Perched	Dec-Apr	>60	---
Pt*. Pits									
SaA, SaB----------- Sadler	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	50-80	Hard
Ud*. Udorthents									
Vc----------------- Vicksburg	B	Common-------	Very brief	Jan-Apr	2.5-4.0	Apparent	Dec-Apr	>60	---
Wa----------------- Waverly	D	Common-------	Brief to long.	Jan-Apr	0.0-1.5	Apparent	Dec-May	>60	---
Wd----------------- Waverly	D	Frequent-----	Very long-	Jan-Dec	1.0-0.0	Apparent	Jan-Dec	>60	---
We----------------- Weinbach	C	Rare---------	Very long-	Jan-Dec	0.5-1.5	Perched	Dec-Apr	>60	---
WlB, WlC, WlC3, WlD, WlD3, WlE--- Wellston	B	None---------	---	---	>6.0	---	---	40-72	Hard
ZaB, ZaC, ZaC3---- Zanesville	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	40-80	Hard

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING TEST DATA

[Tests performed by the Commonwealth of Kentucky Department of Transportation, Bureau of Highways, Division of Research, in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO)]

Soil name	Classification		Depth	Grain size distribution[1]							Liquid limit[2]	Plasticity index[3]	Moisture density[4]	
				Percentage passing sieve--				Percentage smaller than--						
	AASHTO[5]	Unified[6]		No. 4	No. 10	No. 40	No. 200	0.05 mm	0.005 mm	0.002 mm			Maximum dry density	Optimum moisture
			In								Pct			
Belknap silt Loam: (S71KY75-13).	A-4(2)	CL-ML	12-35	100	100	99	94	86	21	14	24	4	108	16
	A-4(2)	ML	35-68	100	100	99	96	82	19	15	26	3	111	15
Karnak silty clay: (S71KY75-17).	A-7-6(28)	CH	8-24	100	100	99	97	87	51	37	50	25	102	22
	A-7-6(13)	CL	42-65	100	100	99	96	[7]	54	[7]	49	24	104	20
McGary silt loam: (S71KY75-19).	A-7-5(39)	CH	24-45	100	100	99	98	79	56	46	63	33	100	22
	A-7-6(15)	CL	45-66	100	100	99	97	[7]	57	[7]	42	21	107	19
Wellston silt loam: (S71KY75-16).	A-6(10)	CL	5-30	100	100	95	94	89	26	19	28	12	107	15
	A-4(7)	CL	40-50	100	96	90	77	73	31	20	32	10	113	15
Zanesville silt loam: (S71KY89-19).	A-6(15)	CL	8-20	100	100	100	98	96	37	29	36	15	107	17
	A-6(12)	CL	26-45	100	99	98	90	82	29	22	32	14	108	18
	A-6(12)	CL	45-65	96	94	91	78	72	31	26	33	17	112	15

[1]Mechanical analyses according to the AASHTO Designation T-88-72. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[2]Based on AASHTO Designation T-89-68.

[3]Based on AASHTO Designation T-90-70.

[4]Based on AASHTO Designation T 99-74, Method A.

[5]Based on AASHTO Designation M-145-73.

[6]Based Unified Classification D-2487-66T.

[7]Percentage not determined.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Belknap	Coarse-silty, mixed, acid, mesic Aeric Fluvaquents
Calloway	Fine-silty, mixed, thermic Glossaquic Fragiudalfs
Caneyville	Fine, mixed, mesic Typic Hapludalfs
Clifty	Fine-loamy, mixed, mesic Fluventic Dystrochrepts
*Collins	Coarse-silty, mixed, acid, thermic Aquic Udifluvents
*Elk	Fine-silty, mixed, mesic Ultic Hapludalfs
Frondorf	Fine-loamy, mixed, mesic Ultic Hapludalfs
Grenada	Fine-silty, mixed, thermic Glossic Fragiudalfs
Henshaw	Fine-silty, mixed, mesic Aquic Hapludalfs
Karnak	Fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts
Lenberg	Fine, mixed, mesic Ultic Hapludalfs
Lindside	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Loring	Fine-silty, mixed, thermic Typic Fragiudalfs
Markland	Fine, mixed, mesic Typic Hapludalfs
McGary	Fine, mixed, mesic Aeric Ochraqualfs
Melvin	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Memphis	Fine-silty, mixed, thermic Typic Hapludalfs
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Otwell	Fine-silty, mixed, mesic Typic Fragiudalfs
Sadler	Fine-silty, mixed, mesic Glossic Fragiudalfs
*Vicksburg	Coarse-silty, mixed, acid, thermic Typic Udifluvents
Waverly	Coarse-silty, mixed, acid, thermic Typic Fluvaquents
*Weinbach	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

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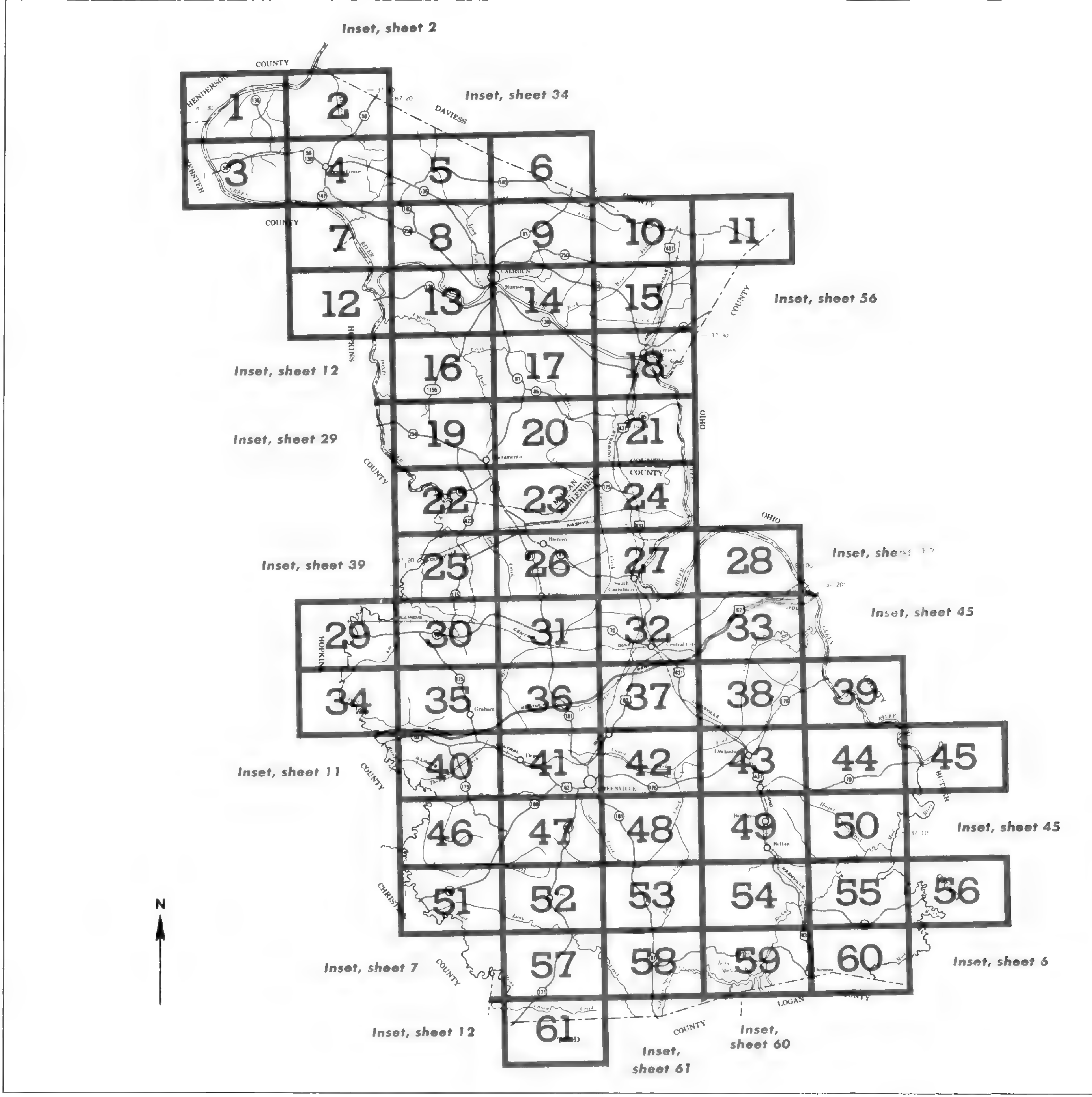

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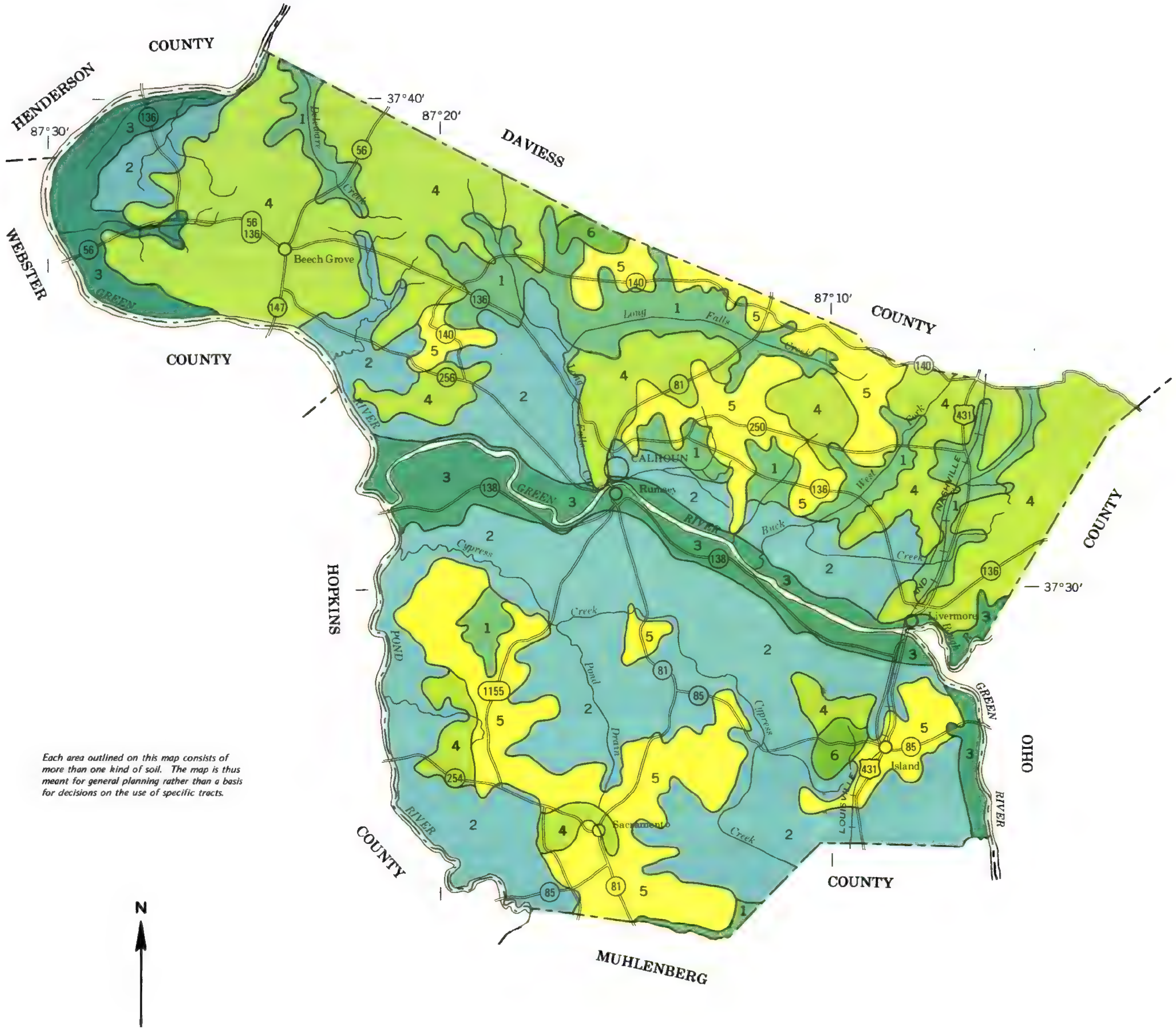

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

LEGEND*

AREAS DOMINATED BY NEARLY LEVEL, LOAMY AND CLAYEY SOILS THAT ARE SUBJECT TO FLOODING

1 Belknap-Waverly: Nearly level, deep, somewhat poorly drained and poorly drained, loamy soils on flood plains

2 Melvin-Karnak-McGary: Nearly level, deep, somewhat poorly drained and poorly drained, loamy and clayey soils on flood plains and stream terraces

3 Newark-Otwell-Melvin: Nearly level and gently sloping, deep, moderately well drained to poorly drained, loamy soils on flood plains and stream terraces

AREAS DOMINATED BY NEARLY LEVEL TO STEEP, LOAMY SOILS ON UPLANDS

4 Loring-Wellston: Gently sloping to steep, deep, moderately well drained and well drained, loamy soils on hilltops and side slopes

5 Grenada-Loring: Gently sloping to moderately steep, deep, moderately well drained, loamy soils mainly on wide ridgetops

6 Udorthents-Zanesville-Wellston: Gently sloping to steep, deep, well drained soils in strip mine areas and gently sloping to steep, moderately well drained and well drained loamy soils on hilltops and side slopes

7 Zanesville-Wellston-Frondorf: Gently sloping to steep, moderately deep and deep, moderately well drained and well drained, loamy soils on narrow hilltops and on side slopes

8 Sadler-Zanesville-Wellston: Nearly level to moderately steep, deep, moderately well drained and well drained, loamy soils on wide hilltops and on side slopes

9 Caneyville-Zanesville-Frondorf: Gently sloping to steep, moderately deep and deep, moderately well drained and well drained, loamy soils on narrow hilltops and on side slopes

*Terms for texture refer to the surface layer of the major soils

(SOIL UNITS 7, 8 AND 9 OCCUR ONLY IN THE MUHLENBERG COUNTY PART OF THIS SOIL SURVEY AREA.)

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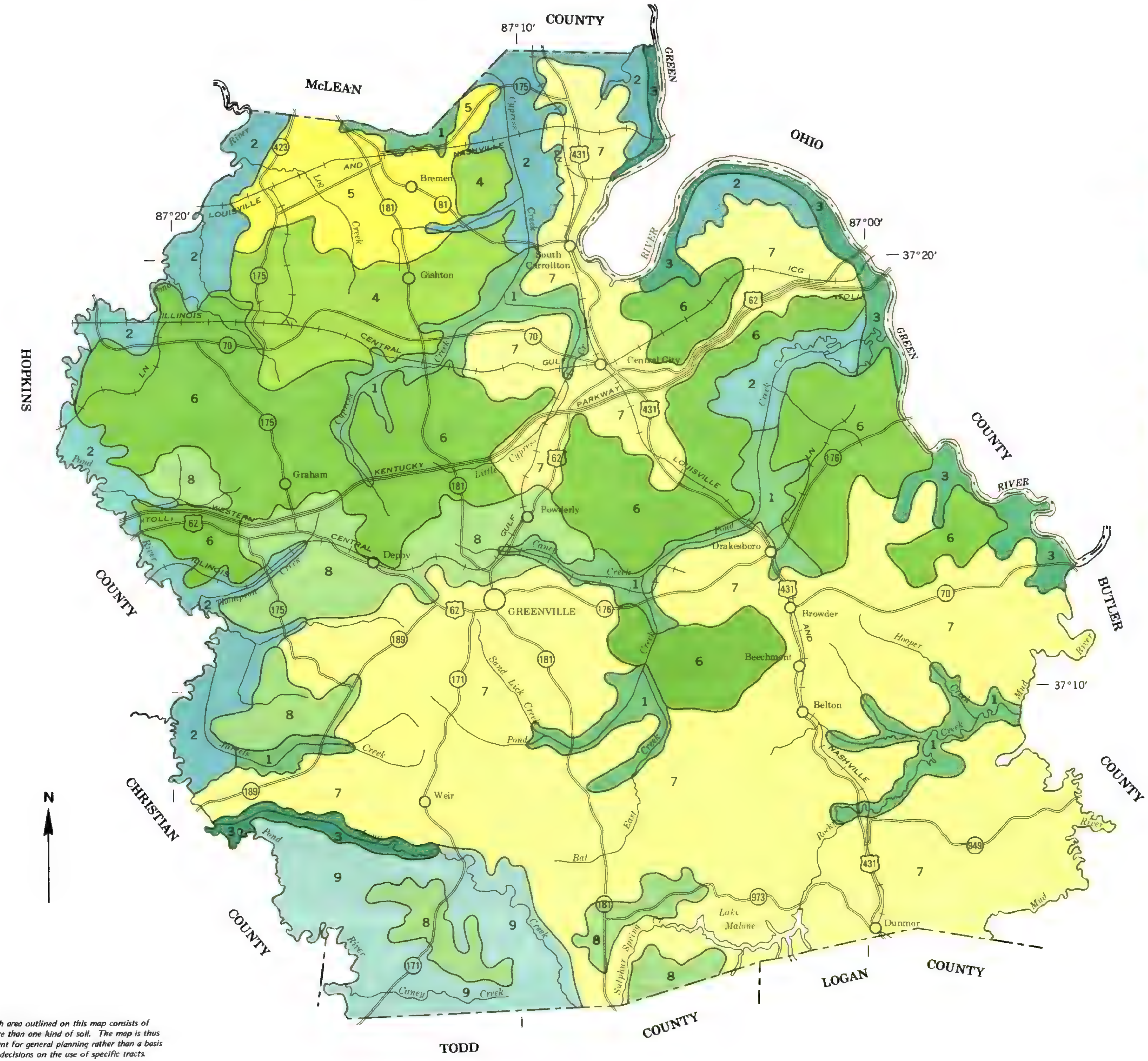
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENTUCKY AGRICULTURAL EXPERIMENT STATION
KENTUCKY DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION

GENERAL SOIL MAP
McLEAN COUNTY, KENTUCKY

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km



LEGEND*

AREAS DOMINATED BY NEARLY LEVEL, LOAMY AND CLAYEY SOILS THAT ARE SUBJECT TO FLOODING

1 — Belknap-Waverly: Nearly level, deep, somewhat poorly drained and poorly drained, loamy soils on flood plains

2 — Melvin-Karnak-McGary: Nearly level, deep, somewhat poorly drained and poorly drained, loamy and clayey soils on flood plains and stream terraces

3 — Newark-Otwell-Melvin: Nearly level and gently sloping, deep, moderately well drained to poorly drained, loamy soils on flood plains and stream terraces

AREAS DOMINATED BY NEARLY LEVEL TO STEEP, LOAMY SOILS ON UPLANDS

4 — Loring-Wellston: Gently sloping to steep, deep, moderately well drained and well drained, loamy soils on hilltops and side slopes

5 — Grenada-Loring: Gently sloping to moderately steep, deep, moderately well drained, loamy soils mainly on wide ridgetops

6 — Udorthents-Zanesville-Wellston: Gently sloping to steep, deep, well drained soils in strip mine areas and gently sloping to steep, moderately well drained and well drained loamy soils on hilltops and side slopes

7 — Zanesville-Wellston-Frondorf: Gently sloping to steep, moderately deep and deep, moderately well drained and well drained, loamy soils on narrow hilltops and on side slopes

8 — Sadler-Zanesville-Wellston: Nearly level to moderately steep, deep, moderately well drained and well drained, loamy soils on wide hilltops and on side slopes

9 — Caneyville-Zanesville-Frondorf: Gently sloping to steep, moderately deep and deep, moderately well drained and well drained, loamy soils on narrow hilltops and on side slopes

*Terms for texture refer to the surface layer of the major soils

(NOT ALL SOIL UNITS OCCUR IN BOTH COUNTIES)

Compiled 1979

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENTUCKY AGRICULTURAL EXPERIMENT STATION
KENTUCKY DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION

GENERAL SOIL MAP
MUHLENBERG COUNTY, KENTUCKY

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CnB, WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

1

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 4

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

5 000 Feet
1 Kilometer
Scale - 1:20000

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 2

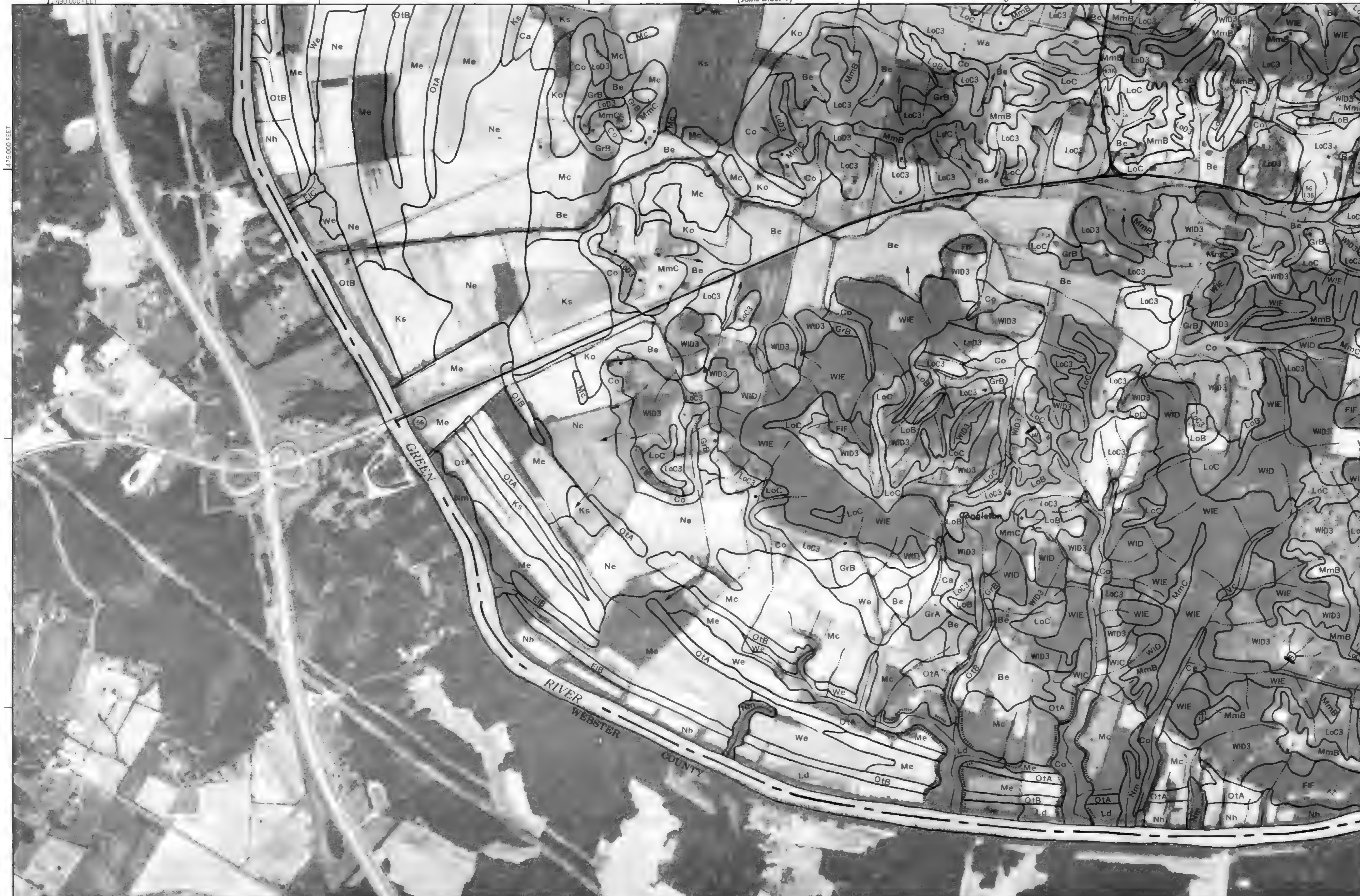
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 2

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 3

MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 3

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



3

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 4

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 4

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 5

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 6

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 7
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 8

MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 9

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 10

N

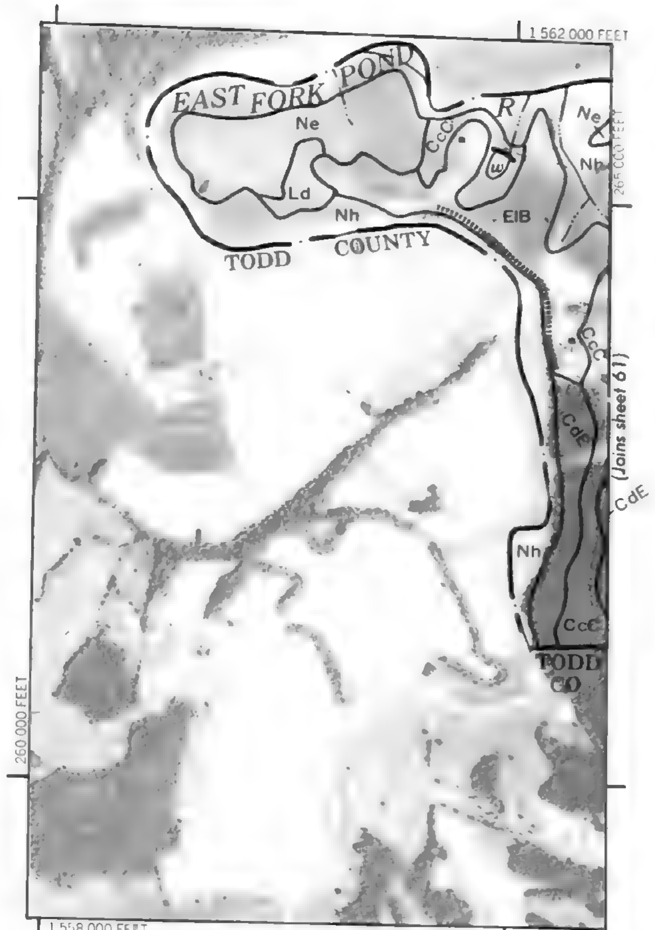
5000 Feet
1 Kilometer
Scale - 1:20000
0 1000 2000 3000 4000 5000
0 .5 1

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 10

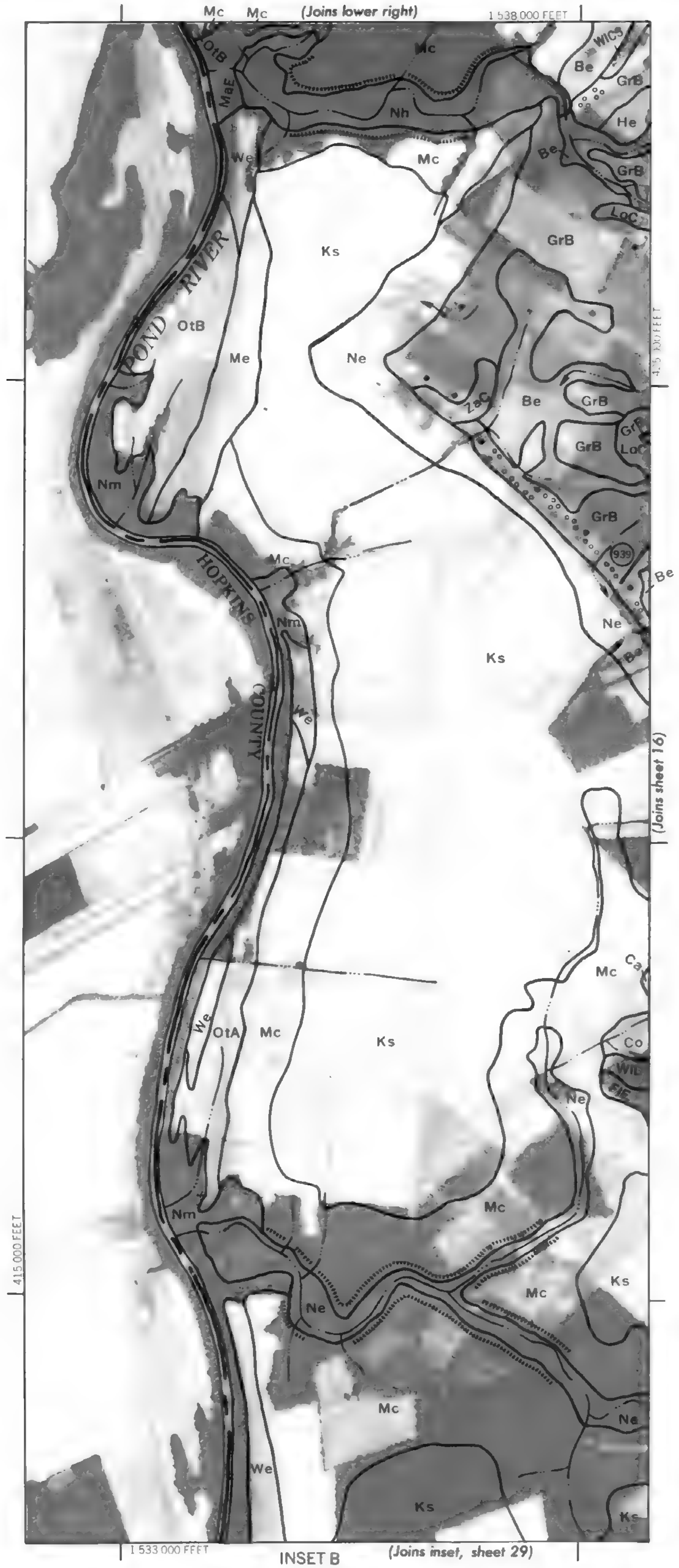
McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 11

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



INSET A

4000 AND 5000-FOOT GRID TICKS



INSET B

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

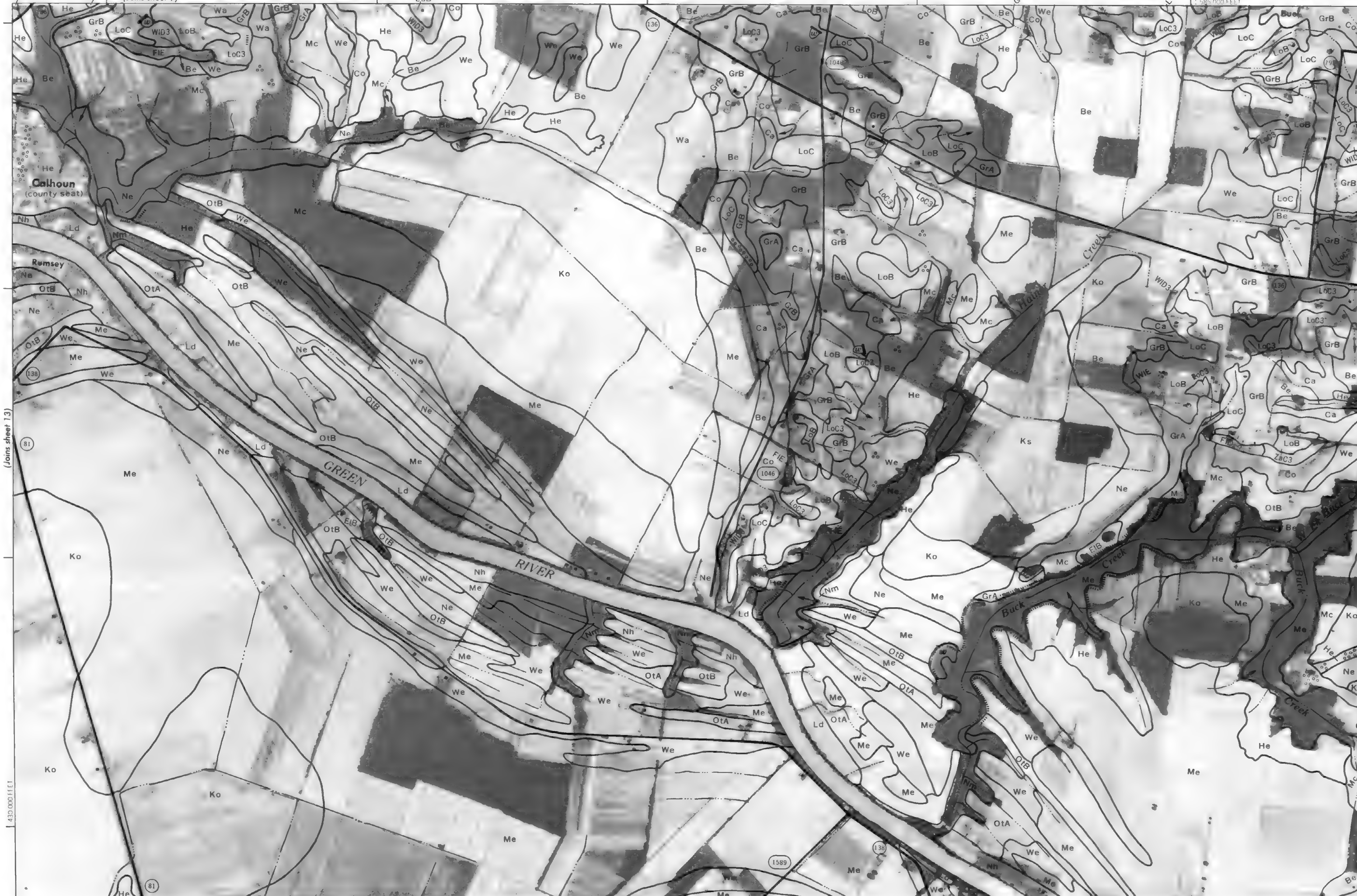
McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 12

13

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 13

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



Scale - 1:20000

5000 Feet

1 Kilometer

0 1000 2000 3000 4000 5000

0 .5 1

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 15

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 13)

N

(Joins inset B, sheet 12)

(Joins sheet 17)

(Joins sheet 19)

Scale - 1:20000

5 000 Feet

1 Kilometer

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 17

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

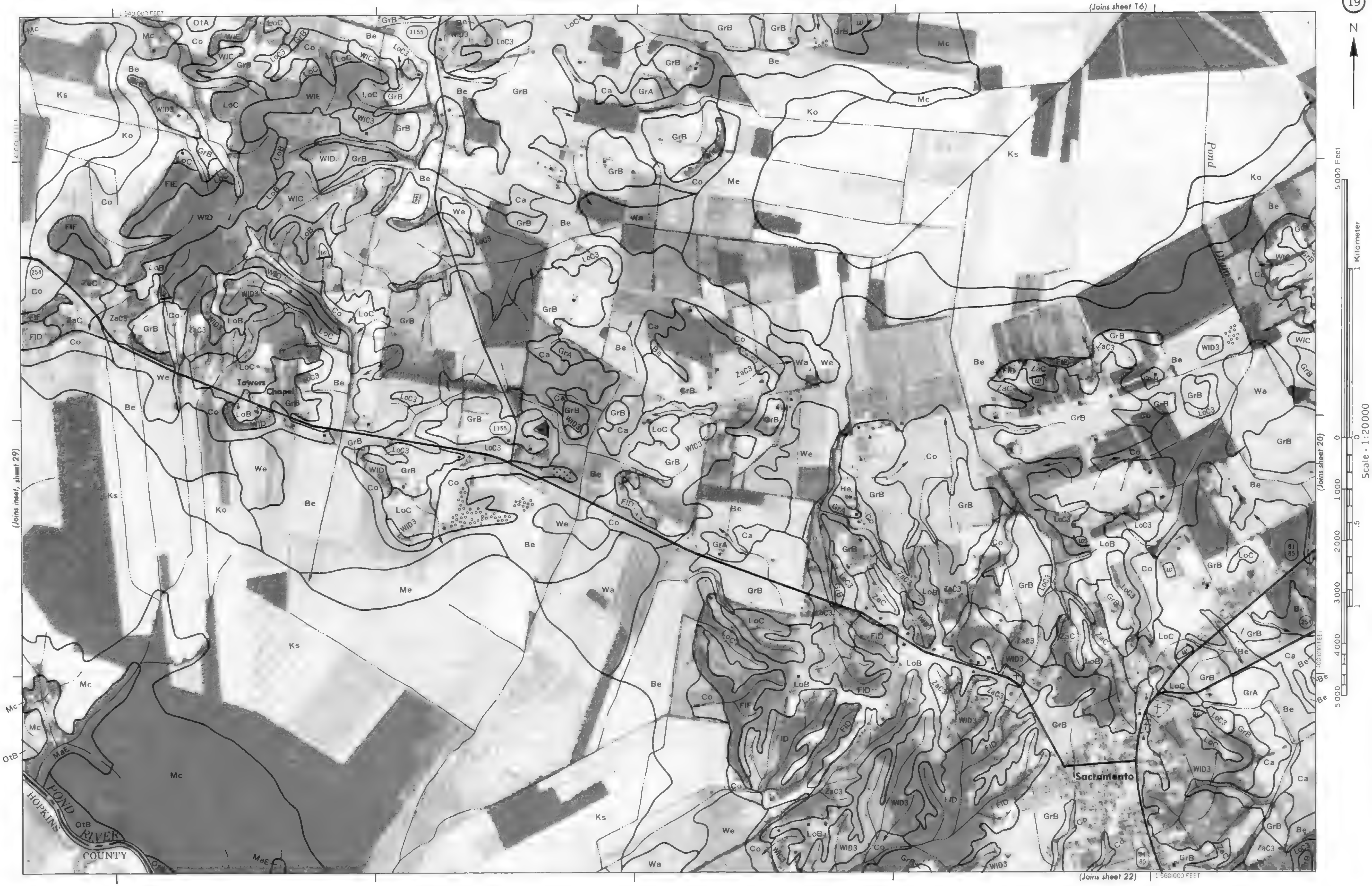
MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 18

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 18

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 19

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 20

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 20

21

N

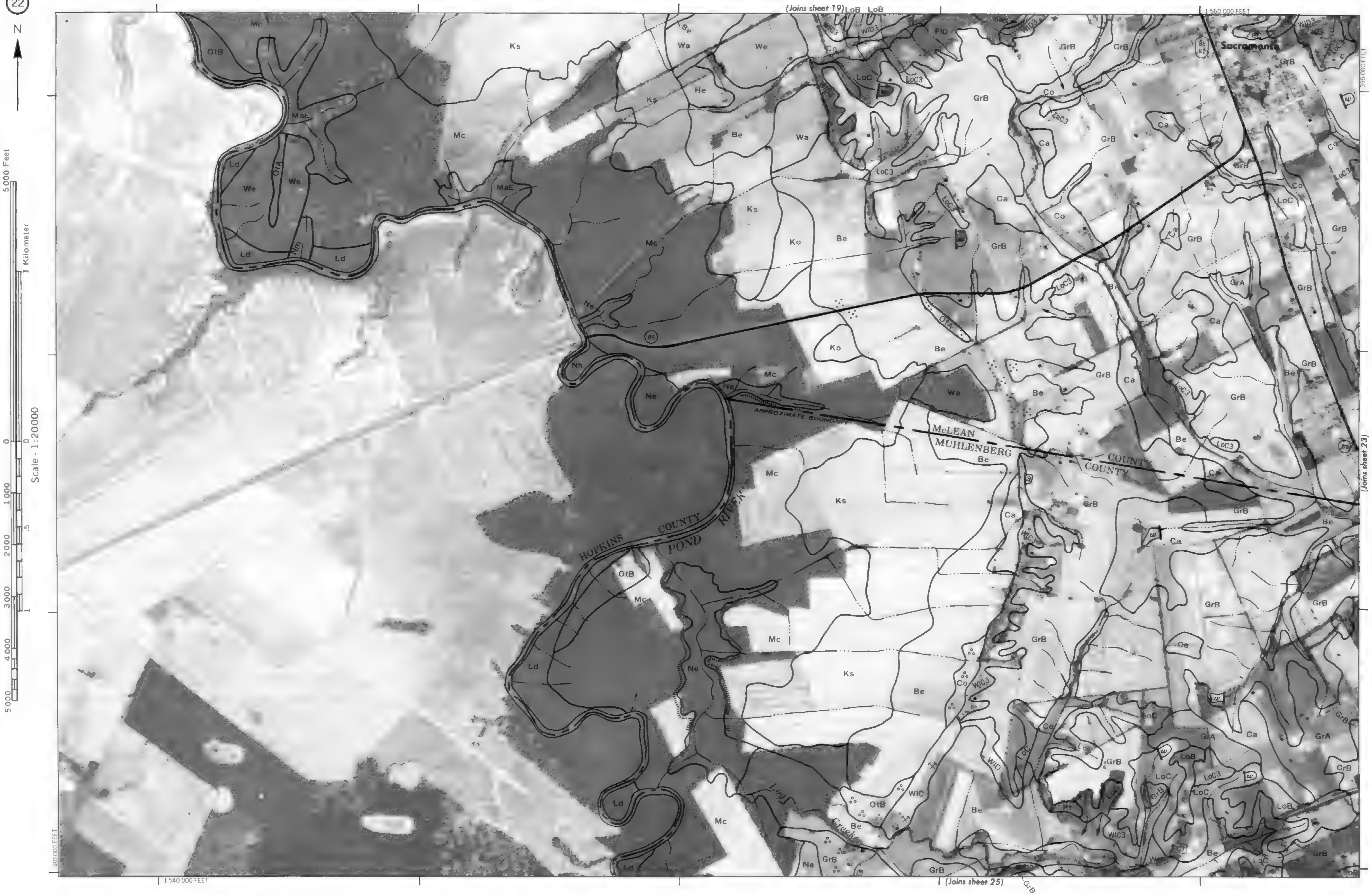
Scale - 1:20000

5000 Feet

1 Kilometer

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 21

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 23

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 24

N

5000 Feet

1 Kilometer

Scale - 1:20000

0 1000 2000 3000 4000 5000

0 .5 1

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

25

N

5 000 Feet
1 Kilometer
Scale - 1:20000
0 1000 2000 3000 4000 5000
0 .5 1

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 25

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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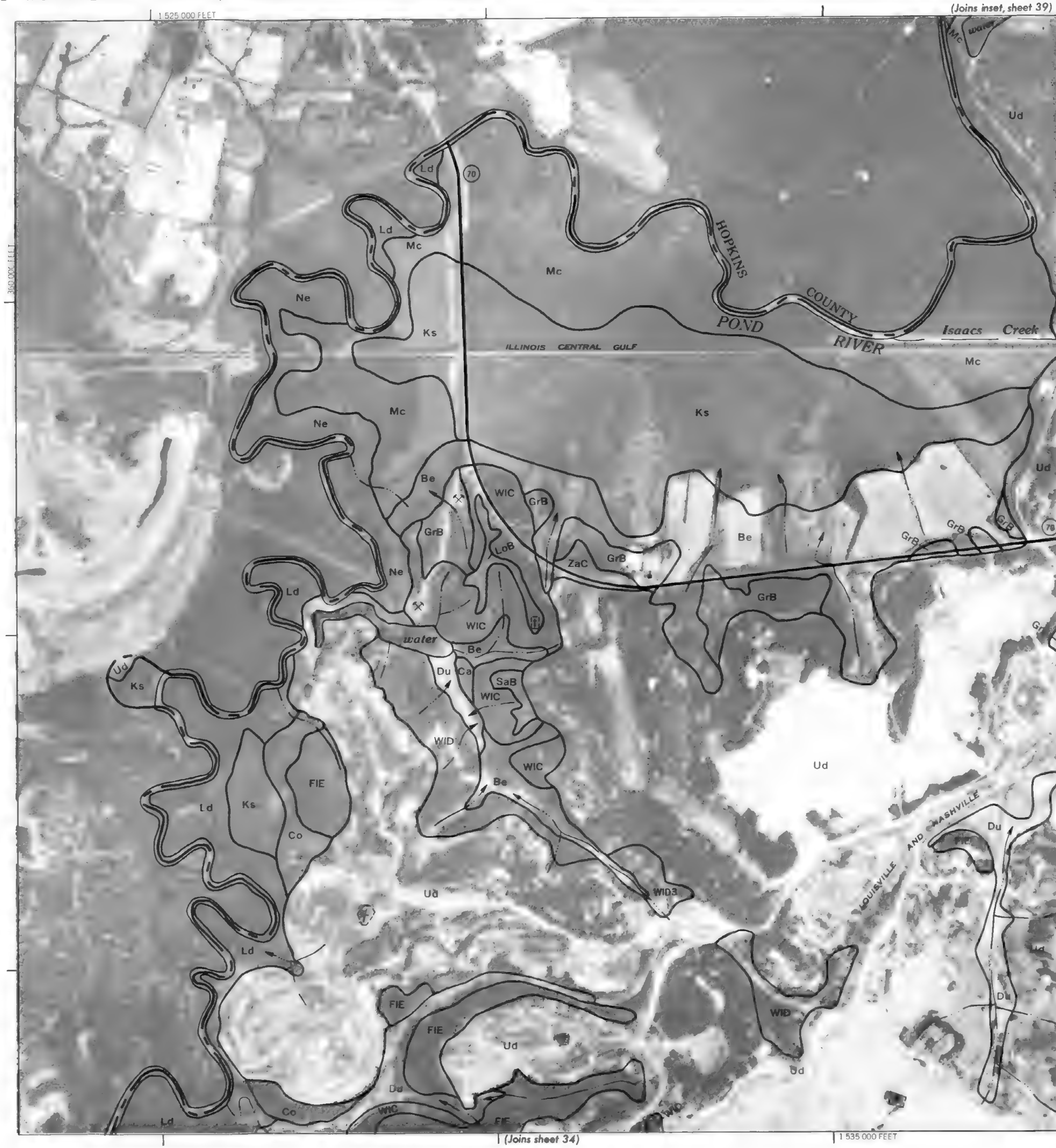
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 28

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 29

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



29

N

5 000 Feet
1 Kilometer
0
0
1 000
.5
2000
3000
1
4 000
5 000
Scale - 1:20000

(30)

N

Scale 1:20000

5 000 Feet

1 Kilometer

0 1000 2000 3000 4000 5000

0 .5 1

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 31

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 32

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 33

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

34

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 34

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 34

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 35

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 36

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 36

N

Scale - 1:20000

1 Kilometer

5000 Feet

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 37

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 38

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 39

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 40

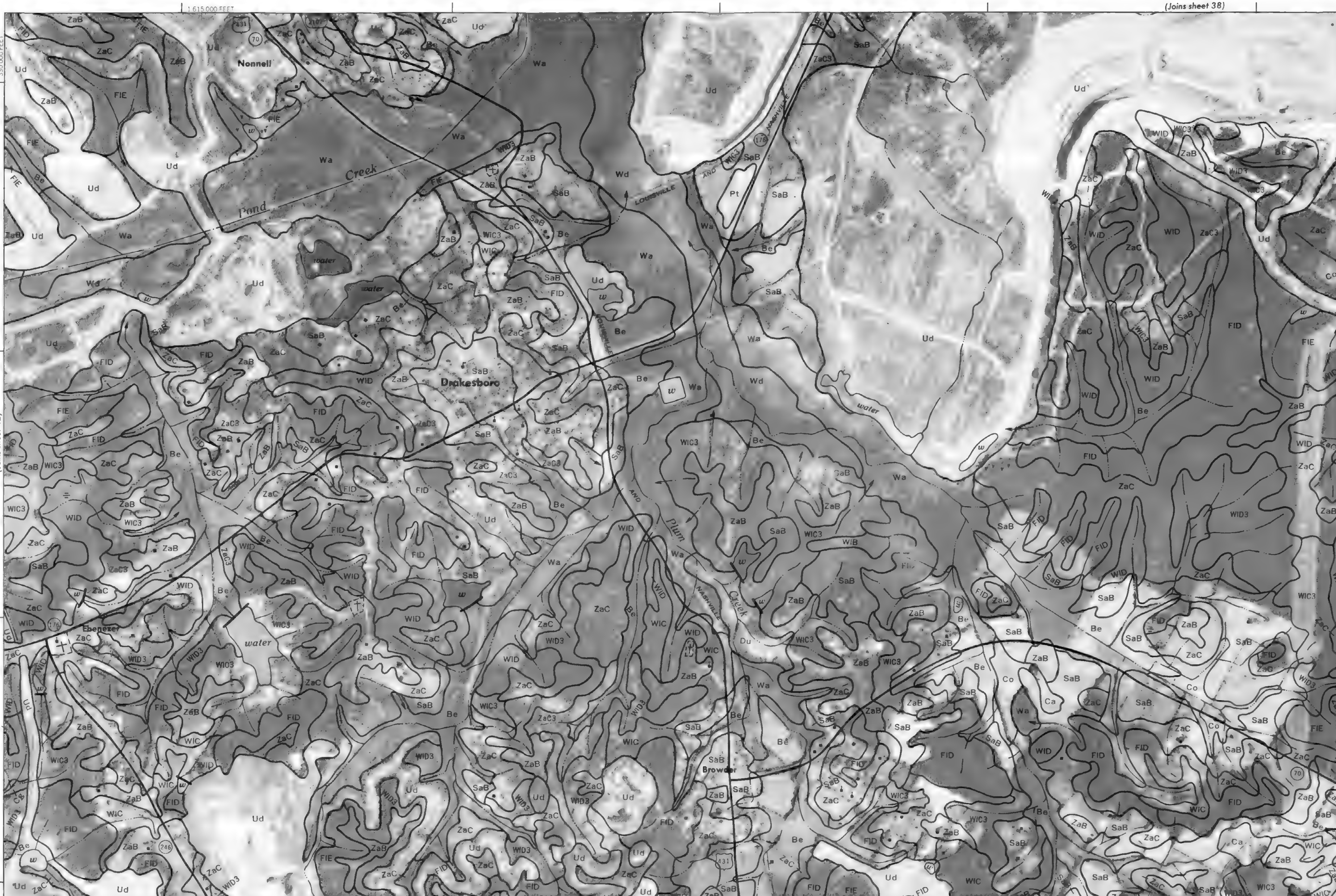
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 41

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

43



N

5 000 Feet
1 Kilometer
Scale 1:20000
0
1000
2000
3000
4000
5000
0
.5
1

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 44

N

Scale - 1:20000

5000 Feet

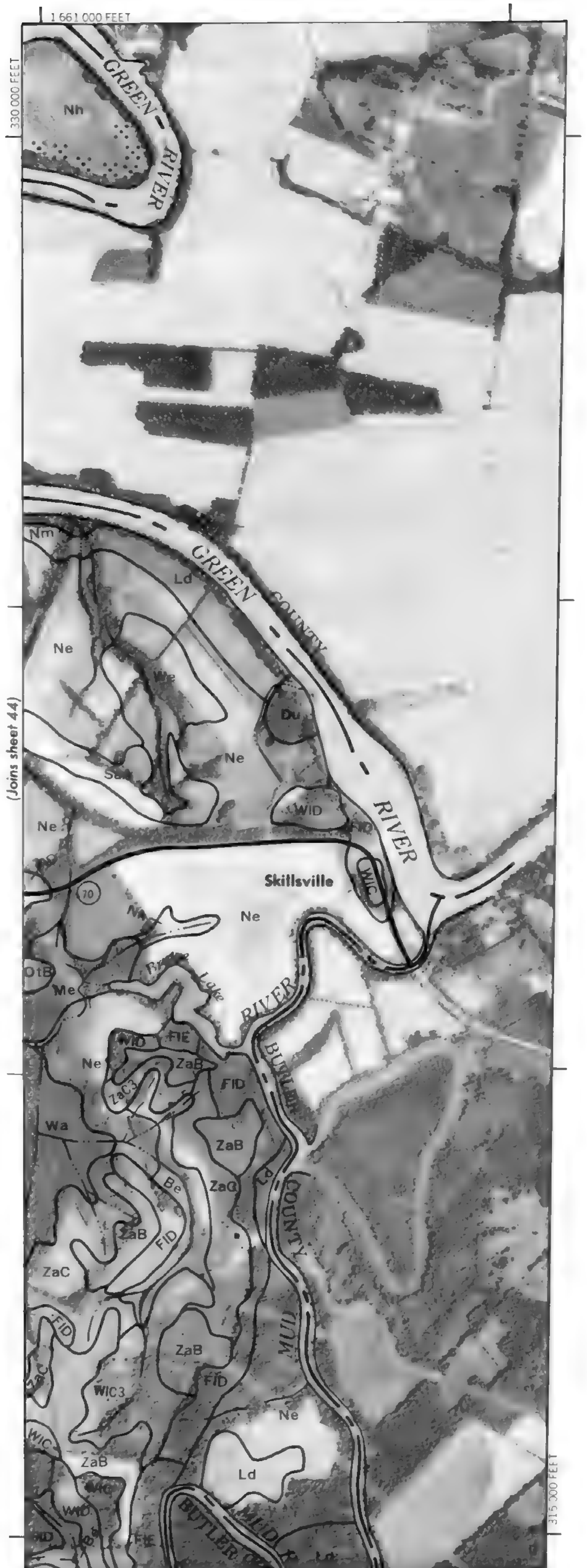
1 Kilometer

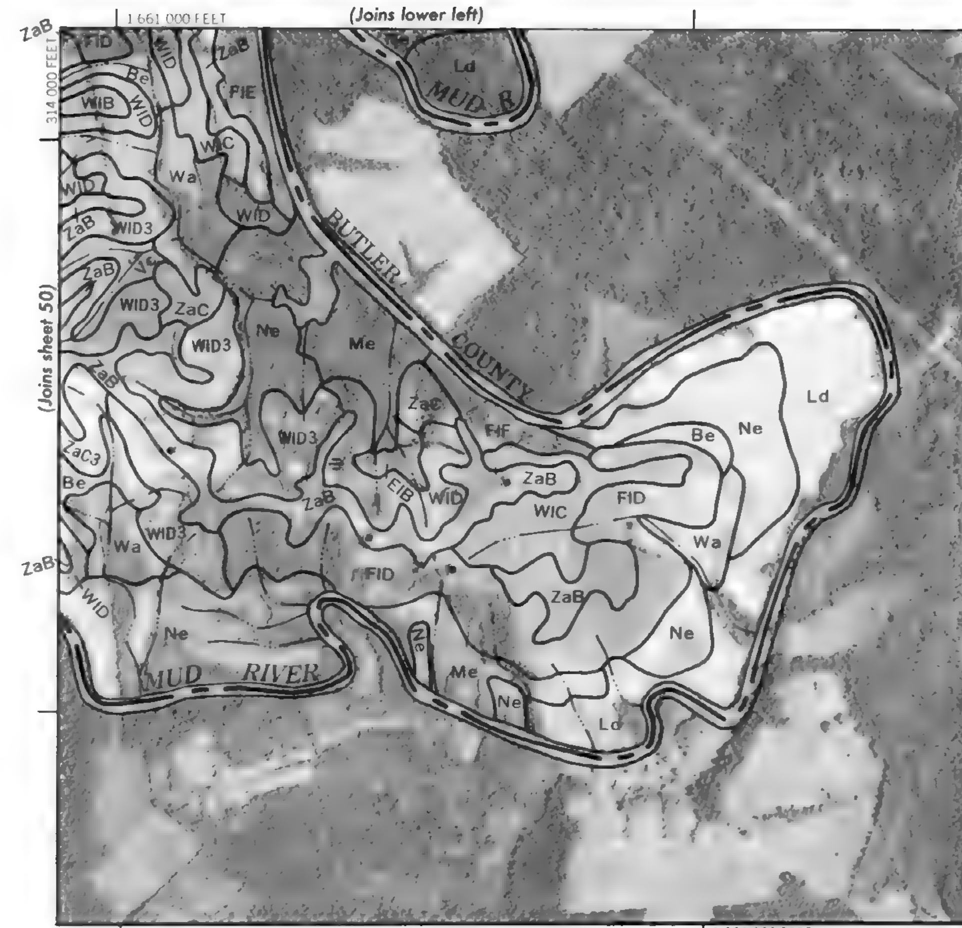
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 44

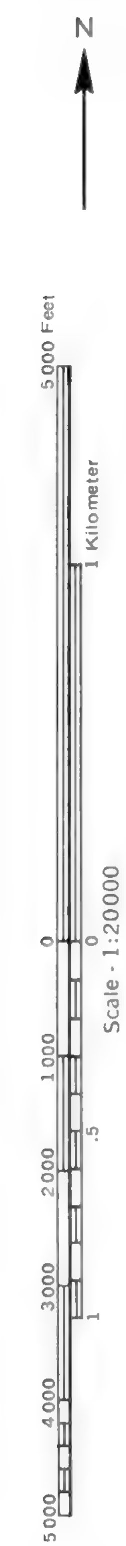
McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 45

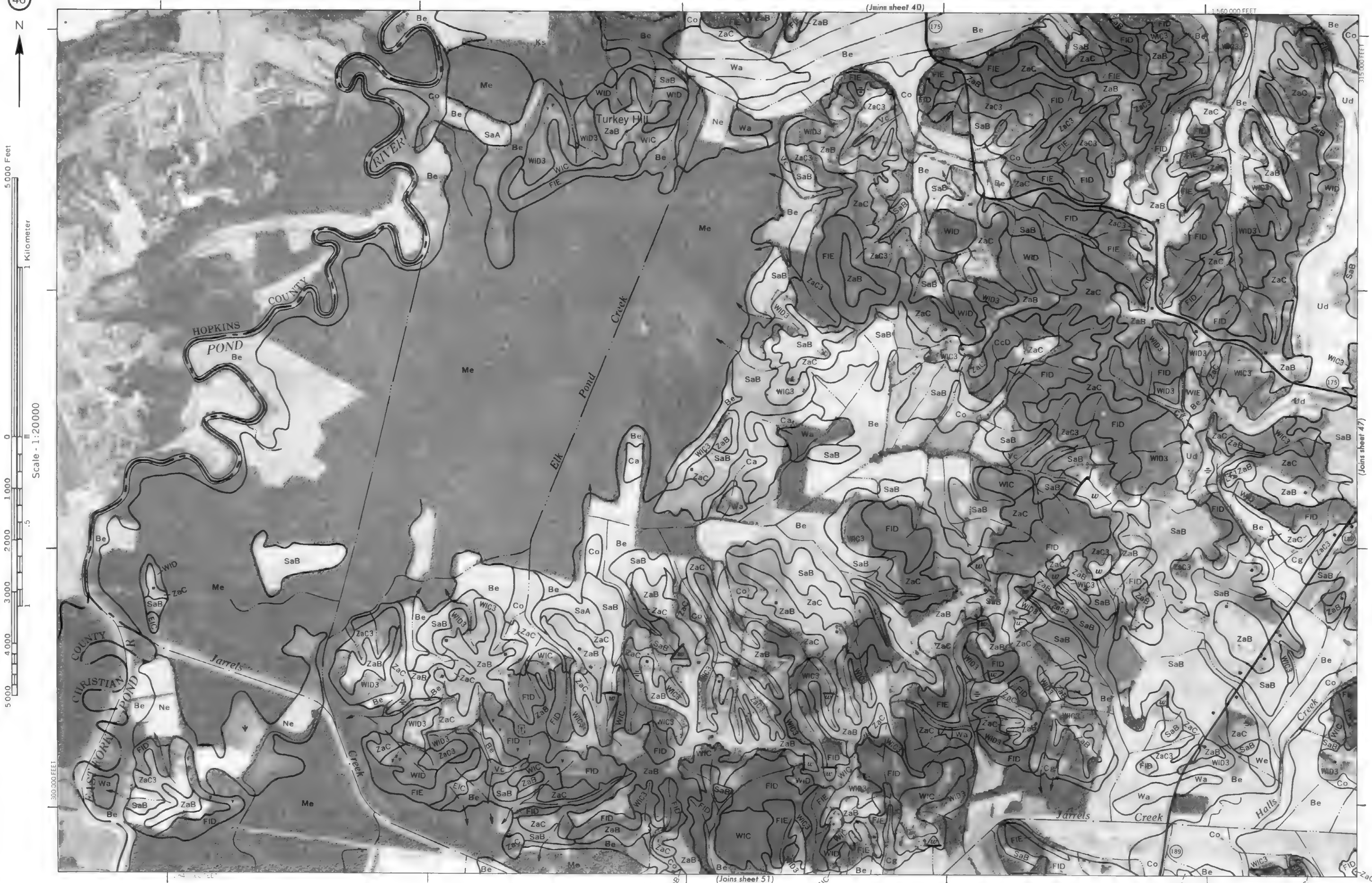
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned





INSET B





This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 47

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

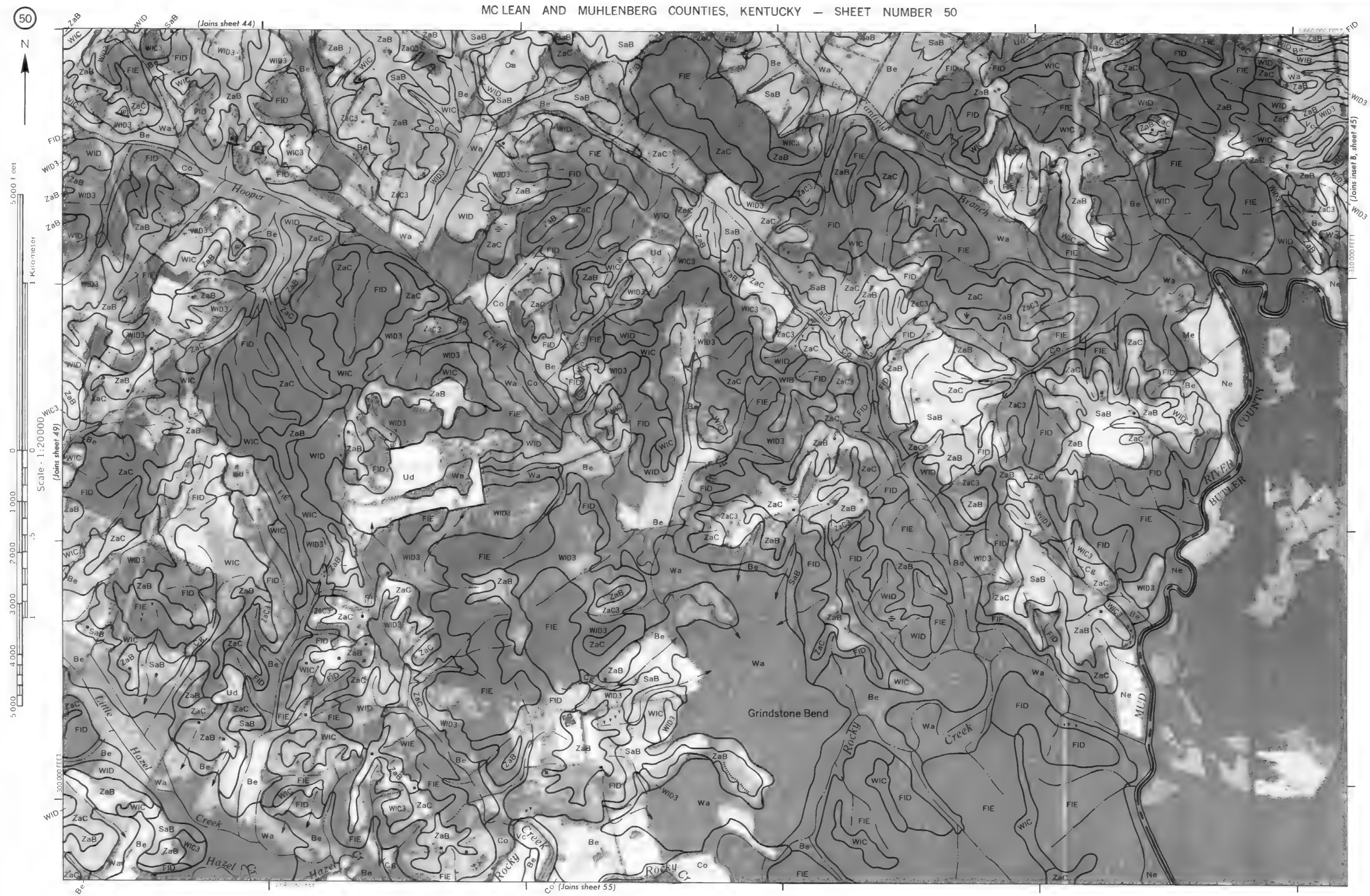
MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 48

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 48

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 49

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



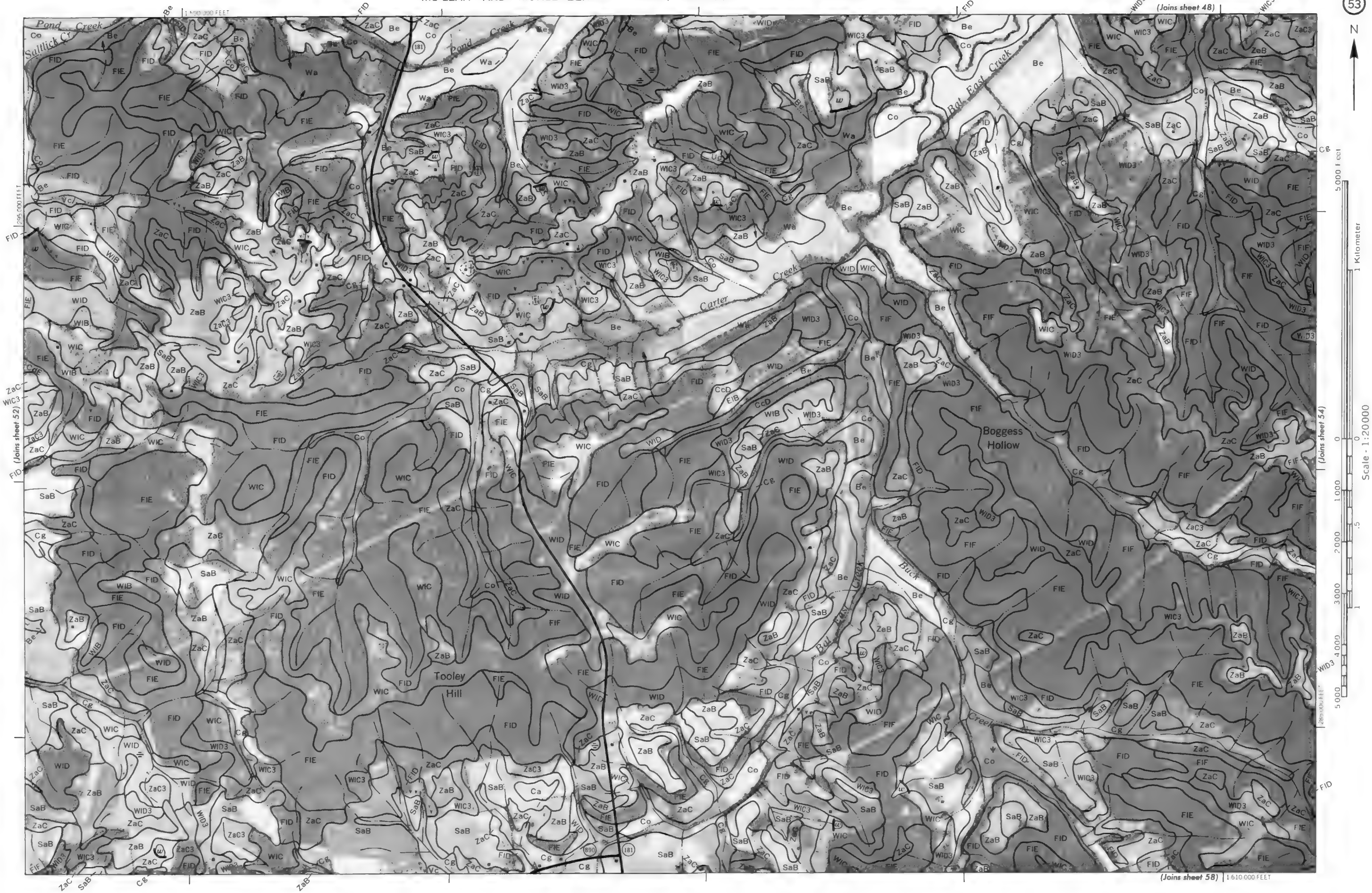
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 51

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

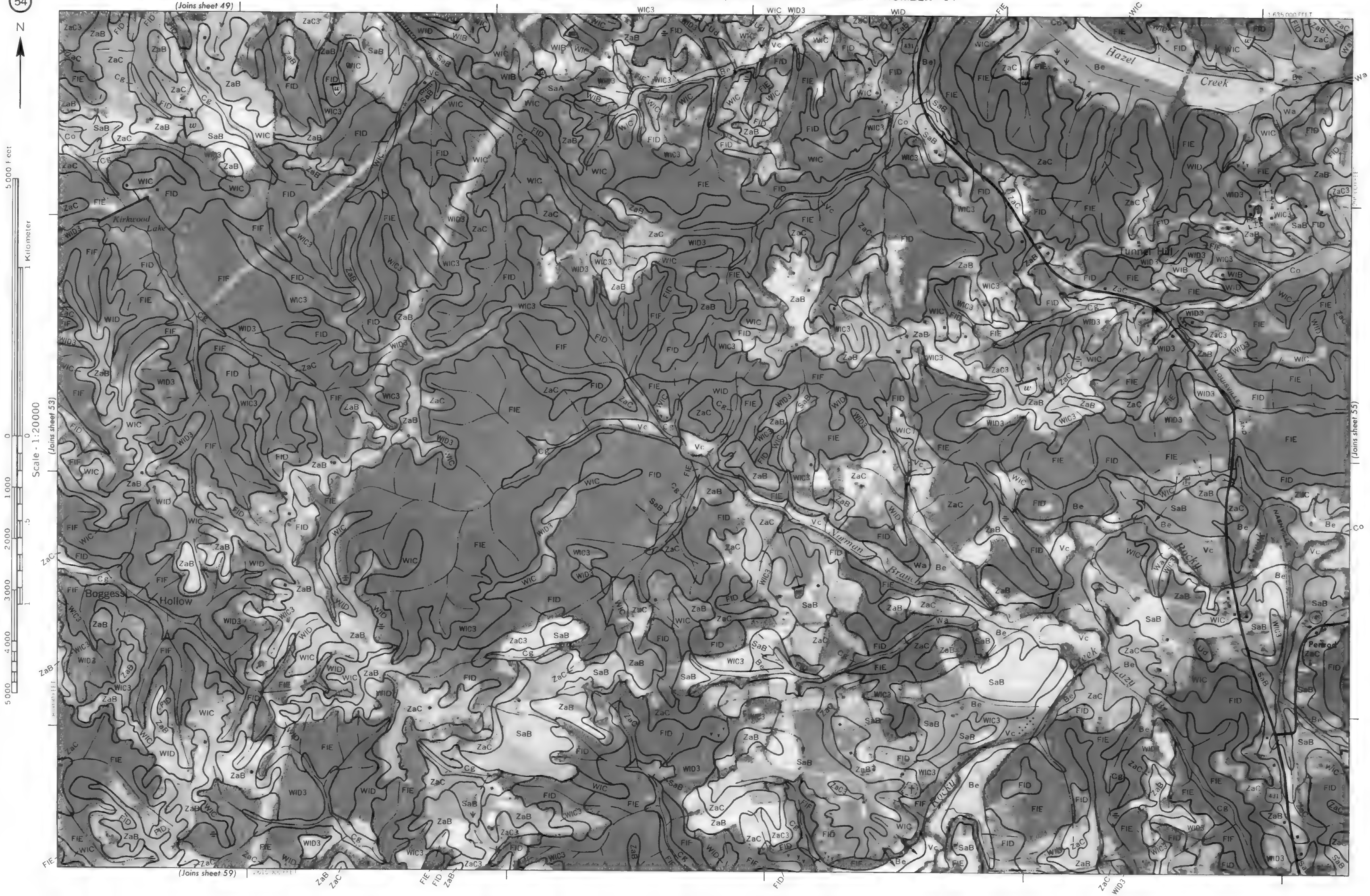
MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 52

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



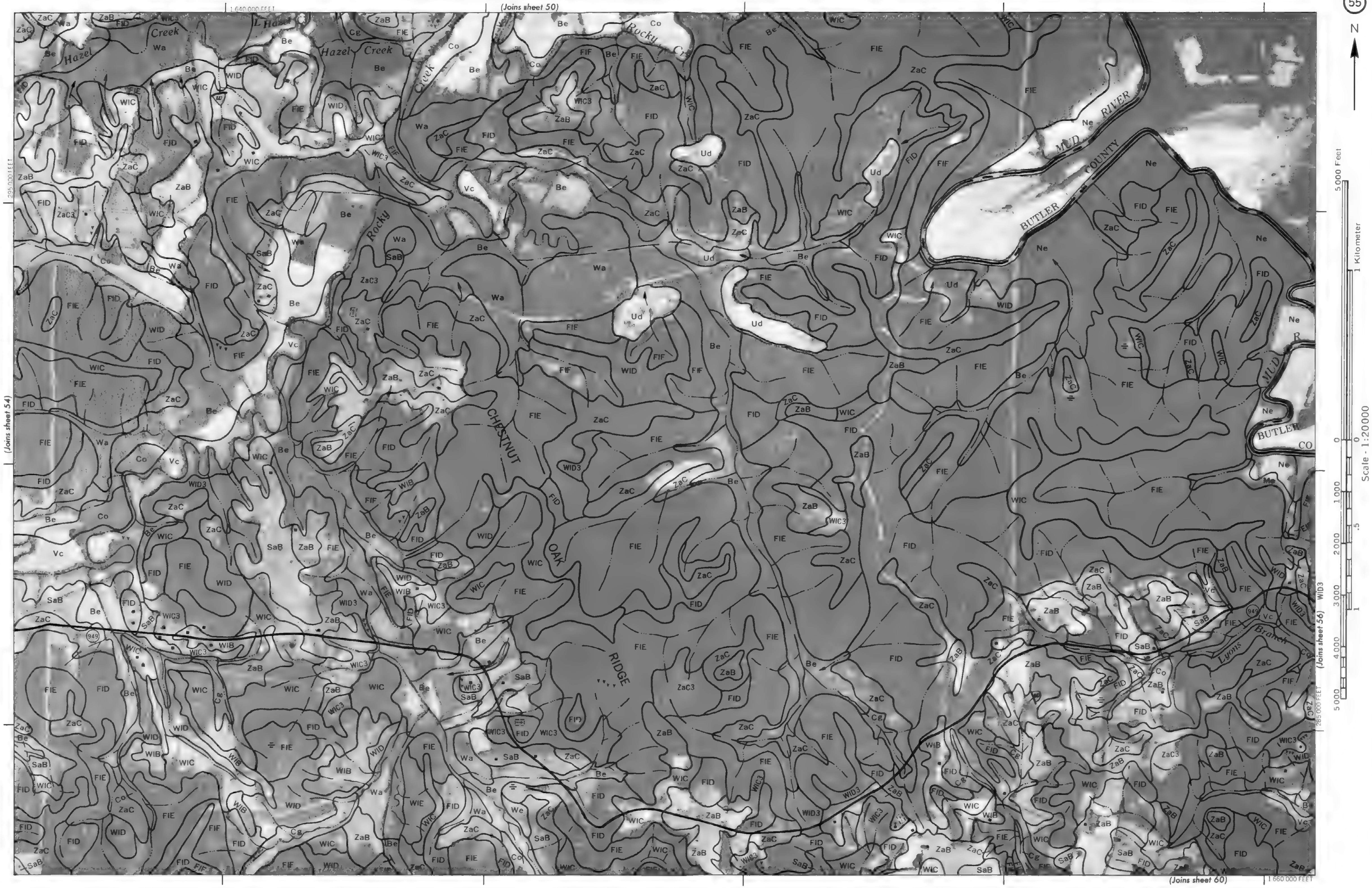
MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 53

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



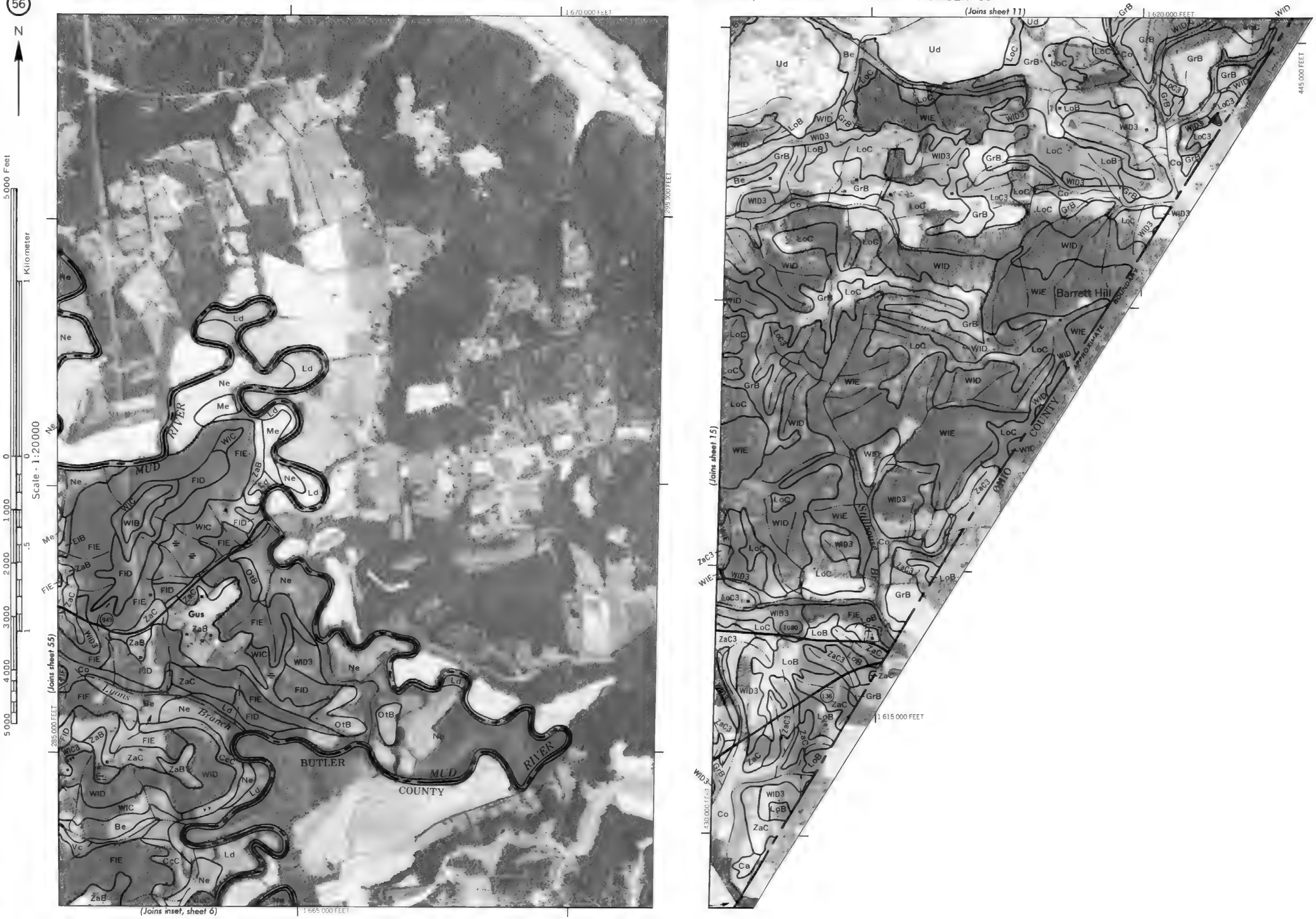
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 55



MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 55

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned



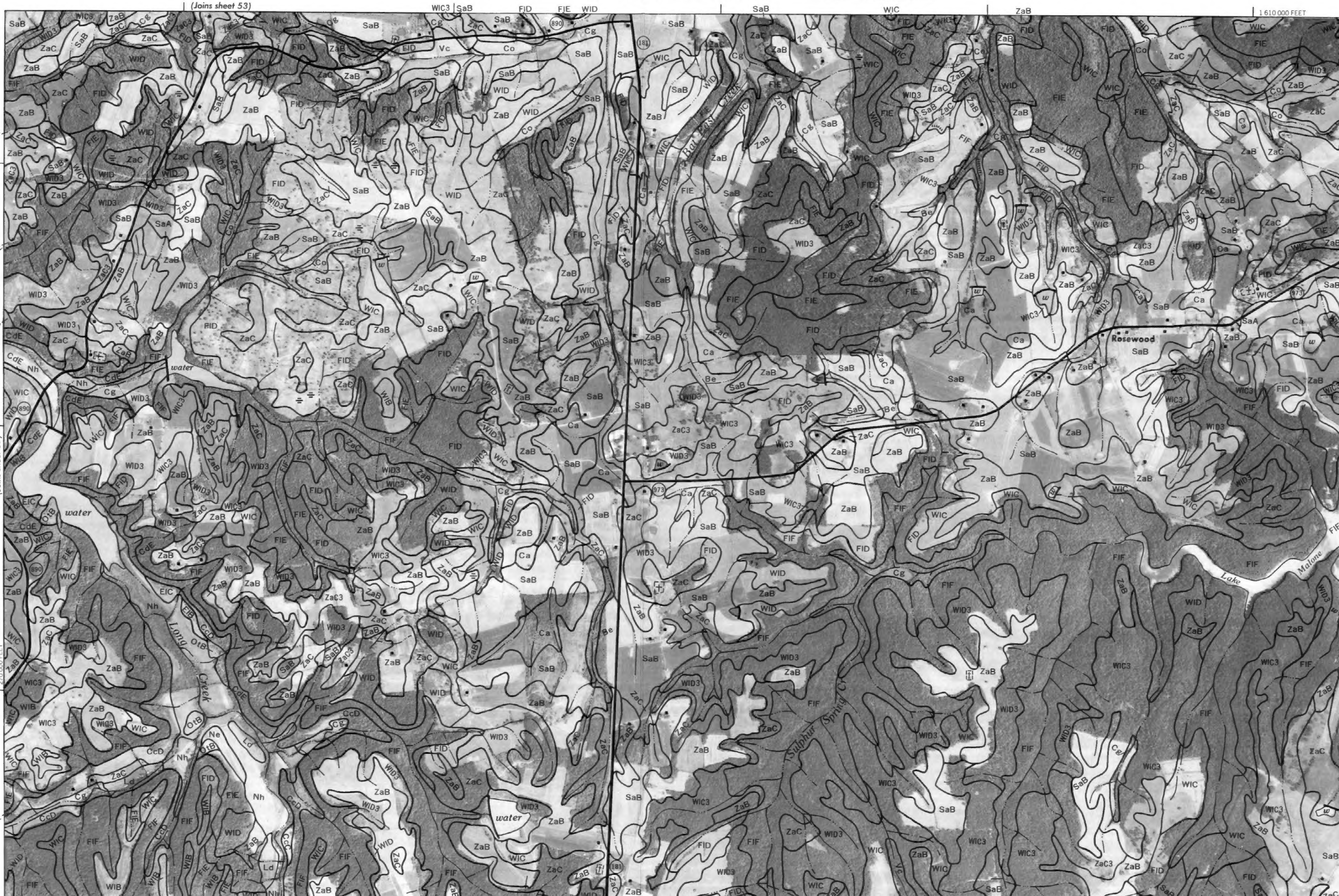
This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 58

N

5000 Feet
1 Kilometer
Scale - 1:20000
0 1000 2000 3000 4000 5000
0 .5 1

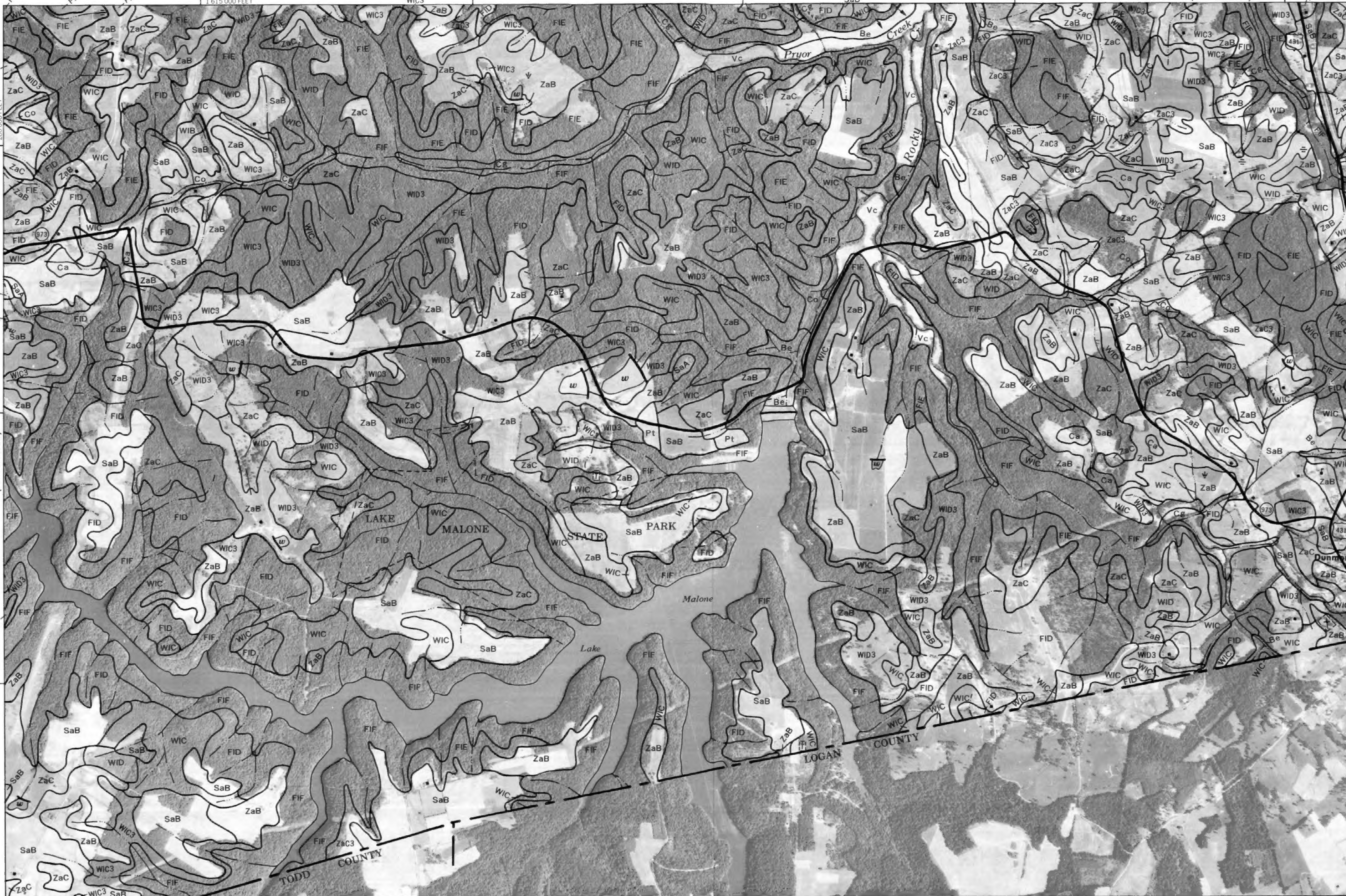


This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

59

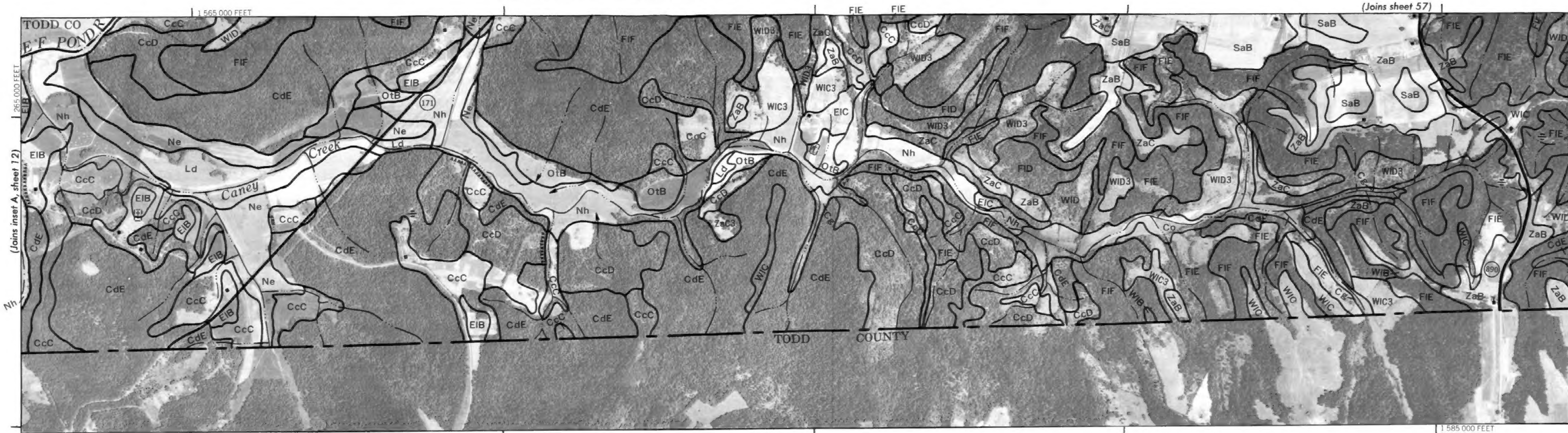
MCLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 59

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



MC LEAN AND MUHLENBERG COUNTIES, KENTUCKY — SHEET NUMBER 60

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



N

Scale - 1:20000

5 000 Feet

1 Kilometer

4000 AND 5000-FOOT GRID TICKS

McLEAN AND MUHLENBERG COUNTIES, KENTUCKY NO. 61

This map is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.